

Metal and Nonmetal National Mine Rescue Contest Rules

U. S. Department of Labor
Mine Safety and Health Administration
1998



Metal and Nonmetal
National Mine Rescue
Contest Rules

U. S. Department of Labor
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1998

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PREFACE

This booklet was prepared for MSHA instructors and inspectors to train mine rescue teams, judges and contest personnel in procedures for a mine rescue contest.

Reference to specific brands, equipment, or trade names in this report is made to facilitate understanding and does not imply endorsement by the Mine Safety and Health Administration.

MISSION STATEMENT

The Metal and Nonmetal National Mine Rescue Contest serves as an effective tool to promote training and improving the skills required to respond to a mine emergency. The National Contest Rule book develops procedures and rules that serve as the basis for actual situations. The cooperation between industry leaders, manufacturers, Federal and State agencies promotes cooperation between different teams and enhances mine rescue preparedness.

ACKNOWLEDGMENTS

A special thanks to the National Metal and Nonmetal Mine Rescue Advisory Committee for their valuable assistance in preparing this booklet. The Advisory Committee consists of:

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The following organizations should be commended for the commitment of equipment and personnel resources in support of the biannual National Metal and Nonmetal Mine Rescue Contests.

Arizona State Mine Inspectors Office
Joseph A. Holmes Safety Association
Mine Safety and Health Administration
Missouri Division of Labor Standards, Mine Safety
National Mine Rescue Association
National Mine Service Company
Nevada State Safety and Training Division
New Mexico Bureau of Mines Inspection
Southwestern Mine Rescue Association
Southwestern Wyoming Mutual Aid Association
United Steelworkers of America
West Virginia University

1996 NATIONAL MINE RESCUE CONTEST CHAMPIONS

OCI of Wyoming

Big Island Mine

OCI White Team Green River, WY

Dave Buller (Captain)

John Aguirre

Walt Mortimer

Mike Pond

Rusty Owens

Doug Degase

Eric Christofferson

Jay Volsey

Tim Musbach (Team Trainer)

Willy Moore (Benchman)

Tim Musbach, Mine Team Leader (Official in Charge)

PREVIOUS NATIONAL CHAMPIONS

- 1996 Big Island Mine, White Team, OCI of Wyoming - Green River, WY
- 1994 Waste Isolation Pilot Plant - Blue Team Westinghouse Electric Corporation, Carlsbad, NM
- 1992 Big Island Mine, White Team, Rhone Poulenc of Wyoming, Green River, WY
- 1990 Magmont Mine Team, Cominco American, Bixby, MO
- 1988 Homestake Mine Gold Team, Homestake Mining Co., Lead, SD
- 1986 Big Island Mine White Team, Stauffer Chemical Co., Green River, WY
- 1984 Texasgulf Mine Gold Team, Texasgulf Chemicals Co., Granger, WY
- 1982 Big Island Mine Blue Team, Stauffer Chemical Co., Green River, WY
- 1980 Lisbon Mine Team, Rio Algom Corp., Moab, UT
- 1978 Jefferson Island Mine Team, Diamond Crystal Salt Co., New Iberia, LA
- 1976 Magmont Mine Team, Cominco American, Bixby, MO (Single-Level Contest)
- 1976 Magmont Mine Team, Cominco American, Bixby, MO (Multi-Level Contest)
- 1975 Big Island Mine White Team, Stauffer Chemical Co., Green River, WY
- 1973 Grand Saline Mine Team, Morton Salt, Division of Morton Norwich Products, Inc., Grand Saline, TX

**PREVIOUS NATIONAL CHAMPIONS
BENCHMAN'S CONTEST**

- 1996 **MACLANE BARTON**, West Fork Mine, Missouri Lead Division, ASARCO, Inc.,
Bunker, MO
- 1994 **FRED MILLER**, Waste Isolation Pilot Plant, Westinghouse Electric Corporation,
Carlsbad, NM
- 1992 **LESLIE WAREHAM**, General Chemical Mine, General Chemical Partners, Green
River, WY
- 1990 **STAN AMRINE**, Parachute Creek Mine, Unocal Mining Division, Parachute, CO
- 1988 **KARL SAUER**, Homestake Mine, Homestake Mining Co., Lead, SD
- 1986 **ART DAVIS**, Henderson Mine, Amax, Inc., Empire, CO
- 1984 **STEVE YANCHUNIS**, Schwartzwalder Mine, Cotter Corp., Golden, CO
- 1982 **ART DAVIS**, Henderson Mine, Amax, Inc., Empire, CO
- 1980 **ALAN HERMEZ** (Draeger), Carr Fork Mine, Anaconda Copper Co., Tooele, UT
- 1980 **RODNEY PHILBRICK** (McCaa), Pine Creek Mine, Union Carbide Corp., Bishop, CA
- 1978 **WILLIE DAVIS** (McCaa), Lisbon Mine, Rio Algom Corp., Moab, UT
- 1978 **KEN JOHNSON** (Draeger), Climax Mine, Climax Molybdenum Co., Climax, CO
- 1976 **STEVE MURRAY**, Bunker Hill Mine, Bunker Hill Co., Kellogg, ID

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GENERAL RULES FOR CONDUCTING THE CONTEST

1. The contest will be comprised of a field problem, a written exam (consisting of 25 questions), a gas test, and a bench contest.
2. Contest officials will be comprised of the Chief Judge, Contest Director, Contest Coordinator, field judges, written exam judges, gas judges, bench judges, mine managers, mine attendants, and isolation officials.
3. There will be no limitations as to the number of teams admitted from any county, state, district, company, or organization. Competitive position is not necessary for entry.
4. Any organization, union, club or local benefit society may enter a team. However, the members of all teams must be bona fide employees of the metal and nonmetal mining industry and meet the requirements set forth in 30 CFR Part 49.
5. Entry forms may be obtained by a written request to:
Metal and Nonmetal Mine Safety and Health Administration, Room 728
4015 Wilson Boulevard
Arlington, Virginia 22203
Telephone Number (703) 235-1565

Entries should then be submitted to the above address at least thirty (30) days prior to the date of the contest. The entry forms will require information regarding the type of equipment each team will be wearing and the type and model of gas testing equipment the team will use during the field problem. Any needed equipment changes requires submission of a modified list to the Contest Director for consideration of approval. (Note: For judging purposes, each judge will be given a list of your equipment prior to working of the problem. This will assist the judges in determining if the proper procedures are being followed for your particular piece of equipment.)

6. Registration will be completed on receipt of a team's entry form. The designated times and locations for each team's participation in the competition will be communicated to the team at the earliest feasible date.
7. Each team entering the Metal and Nonmetal Mine Rescue contest will draw a team placement number to determine the team's order of performance. This drawing will occur at the time of registration for the contest. Random exchanging of position numbers will not be allowed. Changes necessary for management of the contest will be permitted if the Contest Director approves the change. Any team entering the contest who has not competed in a mine rescue contest will compete before other teams, at the discretion of the Contest Director.
8. The day before the contest begins, an enrollment check will be conducted at a designated time and location. Programs, souvenirs, and banquet tickets will be distributed to the teams and the team's order in the contest will be verified at that time.
9. On the day of the field problem, all teams should be in isolation, at a designated location,

one hour prior to the start of the contest. Any team not in isolation when the first teams are called for the Mine Rescue Contest will be disqualified.

10. The Metal and Nonmetal Mine Rescue Contest will begin at 8:00 a.m. or earlier at the discretion of the Contest Director.
11. In mine rescue ties, the underground discount sheet will be the first tie breaker, the surface discount sheet will be the second tie breaker, mine maps will be the third tie breaker, the written test will be the fourth tie breaker, the gas test will be the fifth tie breaker, and time will be the sixth tie breaker.
12. The captain and one other team member will be given an opportunity to review their discounts with the field judges following the working of the problem by the team. The judges will discuss and tabulate field discounts and meet with team members at an agreed upon, isolated location. The review will be limited to 5 minutes. Where discounts assessed by judges for infractions, such as improper equipment use, missing identification tags, can be verified were improper, the number one judge may make appropriate corrections. Any changes must be documented fully and receive concurrence from the judge assessing the discount. If the Captain feels issues related to the working of the problem or discounts assessed for judgment calls were inappropriate they can use the appeal process after the team examines all field, gas and written discounts are reviewed. **THIS REVIEW IS NOT TO BE CONFUSED WITH THE APPEALS PROCESS AND CAN BE TERMINATED BY THE NUMBER ONE JUDGE AT ANY TIME IF THE REVIEW BECOMES UNRULY.**
13. Discounts will not be added to the team's field score once the judges have signed their discount sheets following the review with selected team members. This does not preclude changes due to administrative errors or a mis-application of a rule.
14. After the score cards are checked by the score card examiners, they will be taken to a designated location. The team captain and one other team member may examine their team scoring cards for a time not to exceed 20 minutes. No protest of the discounts assessed may be given to the person in charge of the review, however, the team captain and/or trainer may protest in writing any discount within one hour after reviewing them. Written appeals are not to exceed one page for any discount assessed and will be submitted to the Appeals Committee. Any protest(s) will be considered by the Appeals Committee. A discount summary sheet will be used to list the discounts. All discounts except time will be listed and totaled. Both the captain and the review judge will sign the discount sheet to certify they have reviewed the discounts and verified the totals. **(See Example A)**
15. The Appeals Committee, composed of the Contest Director, Chief Judge, and Contest Coordinator, shall be the final arbiter of any interpretations, procedures, or any matter involving proper conduct of the Contest. Any complaints filed with the committee shall be in writing and shall set forth incidents, times, names, source of information, and the act complained against. Where a written test question or rule application was found to be wrong, all teams will receive the appropriate correction. A decision by a majority of the committee shall be binding.

16. Information regarding trophies and plaques will be found in the program.
17. The winning teams will be announced during the banquet.
18. Following the awarding of the trophies and plaques, team ratings will be available to the teams. The results from all elements of the contest will be given to the teams at the earliest possible time.
19. All rules relating to the contest will be rigidly enforced.
20. All hours mentioned in the rules are based on local time.
21. Thirty days prior to the contest, contest equipment will be accepted at an address to be specified. The cost of all shipments must be prepaid, and all boxes, cartons, etc. should be clearly labeled "Hold for National Mine Rescue Contest."
22. An ambulance and a first aid station will be available.
23. On the day prior to the contest, a meeting will be held to discuss officials' assignments and conduct judges training. All personnel who will be officiating during the contest shall attend this meeting.

EXAMPLE A..

**National Mine Rescue Contest
Team Discount Summary Sheet**

Team No. _____

Company Name _____

Team Name _____

Judge #1 Surface _____

Underground _____

Judge #2 Surface _____

Underground _____

Judge #3 Surface _____

Underground _____

Written Test _____

Gas Test _____

Map _____

Total Discounts _____

Excluding average time _____

I certify that I have read and reviewed all discounts listed
above.

Team Captain

Review Judge

GUIDELINES AND PROCEDURES

Team Members, Alternates and Attendants

Each team shall be composed of a minimum of five members and one Alternate unless otherwise approved by the contest director. Each member shall wear a number on the arm at or near the shoulders with number one (1) being assigned to the captain and the 6th to the alternate. Switching of numbers by team members will not be permitted after arriving at portal or fresh air base. Any means of affixing legible numbers on the sleeve of the uniform will be acceptable.

Teams may utilize an alternate as a fresh air base attendant. Each attendant must be employed by the same organization as the team members, will accompany only one participating team, and may assist that team with any of the functions normally performed prior to entering the mine. Any number of people may assist the team placing equipment prior to starting the clock. However, only one attendant will be allowed to physically assist the team after the clock is started.

One attendant and alternate can be stationed at the fresh air base during the working of the problem. The attendant and alternate will be permitted to communicate with the team and may mark the map from information received from the team. The Fresh Air Base Attendant and any other Alternate will be isolated from visual contact with the field.

Teams wishing to communicate with the fresh air base attendant shall use the mine's communication system, a portable communication system, or return to the fresh air base.

Each team may bring one or more Alternates to be available for use if a regular member becomes sick or is otherwise unable to compete. If a team member gets sick or is unable to continue during the working of the problem, and an alternate takes his/her place, the team members may be rearranged at the team's discretion. Alternates may also be used as survivors. An alternate who has gained knowledge about the problem because of being in the mine (beyond the fresh air base) during the team's working of the problem, may not be used to substitute for a sick team member. A team member replaced by an alternate cannot participate in the problem in any manner.

Medical Requirements

A letter from management or physical examination forms, dated within the 12 months preceding the contest showing that each member of the team is physically sound and capable of performing strenuous work under oxygen, shall be provided at the time of team registration.

Equipment

Each team member must have his/her own approved breathing apparatus. Each team must have approved gas detectors or testers for rescue and recovery work. In the event of malfunction or damage, instruments, gas detectors, or testers will be furnished upon request by the field committee before that team leaves the guarded area. However, there is no guarantee to provide

any special type of equipment.

Teams cannot expect recharging materials, apparatus parts and accessories for all types of apparatus at the contest site.

Team members must wear an approved protective hat, identification tag, safety shoes, permissible cap lamps, self-rescuer, and be clean shaven to the extent that a good face-to-facepiece seal is achieved.

Breathing apparatus approved for at least two hours shall be used in the Mine Rescue Contest problems.

Teams are required to bring with them a sufficient supply of materials.

Brattice, boards, or plastic necessary for constructing bulkheads or stoppings (if necessary in problem) will be furnished by the field committee. Teams will be responsible for collecting the material from the source of supply. (Staplers will not be permitted in lieu of hammer and nails.)

When teams report to the fresh air base to begin the problem and are told or given information indicating that explosive gas(es) is/are or may be present in the mine, they must use non-sparking tools while they are working the problem so as not to endanger themselves. If teams do not have non-sparking tools, they must ask the official in charge at the fresh air base to provide them with such tools before they go underground.

If the mine is not classified as gassy and the teams go underground to work the problem and encounter an explosive gas and they do not have non-sparking tools, they must return to the fresh air base immediately and ask the official in charge to provide them with such tools. For the purposes of the Mine Rescue Contest, carbon monoxide (CO) will not be considered an explosive gas unless it is in the explosive range.

Team Preparation (Apparatus)

Team members must make necessary checks of all apparatus for proper working condition and airtightness prior to reporting to the mine entrance. Cylinder pressures must be within specifications of approval.

Apparatus tests must comply with prescribed tests for that particular type of apparatus.

An approved 2-hour, 3-hour or 4-hour oxygen breathing apparatus must be used on the survivor(s) or other rescued personnel when respiratory protection is needed. A one-hour self-rescuer is not to be used for the evacuation or rescue of survivors.

Written Test

Written tests will be administered to all team members at the same time, unless authorized otherwise by the Contest Director. The questions for the written test will be taken from material contained in MSHA approved mine rescue training modules 2202 Mine Gases, 2203 Ventilation, 2204 Exploration, 2205 Fire, Fire Fighting, and Explosions, 2206 Rescue of Survivors and Recovery of Bodies, and 2207 Mine Recovery. The written test may also include questions on the particular oxygen breathing apparatus each team will be wearing. Oxygen breathing apparatus questions will be taken from the list of questions for each apparatus included in this manual. MSHA training modules are available at the following address:

U.S. Department of Labor
National Mine Health and Safety Academy
ATTENTION: Facility Support Services
P.O. Box 1166
Beckley, WV 25802-1166
Phone No. (304) 256-3257

The written test of 25 questions for each team member shall consist of true and false and multiple choice questions. Written explanations by contestants will not be considered. In the event an alternate is unavailable, the alternate's score will be the average score of all teams' alternates. A team may participate without an alternate only with approval of the contest director.

In special circumstances, individual team members may be given oral instead of written tests by one or more judges. Requests for consideration shall be presented to the Contest Director at the time of registration. All other team members will take the test at the same time.

Judges will not explain the meaning of questions, but may explain a word or words in the questions.

Judges

The Chief Judge and his/her assistants will be persons trained in the assembly, use, and care of the different types of breathing apparatus, etc., and will not be connected with any of the teams, teams' employers, or companies who manufacture apparatus or gas detecting devices. Exceptions to personnel assigned for judging any phase of the contest requires the approval of the Contest Director.

Competing teams deserve the full attention of the judges and only those personnel judging the specific teams are allowed on the field. Judges must not ask questions or interfere with a team unless health or safety is involved. Judges must stand clear of and not crowd teams checking equipment. Other personnel except those approved by the contest director shall stay off the field. Media access and videos for future training aids will be allowed with the Contest Director's approval.

Only persons trained in the assembly, use, and care of the different types of mine rescue equipment and trained in mine rescue procedures will be used as judges.

A minimum of two persons will judge the gas test, bench test and written test. A minimum of three (3) persons shall judge the team during the entire working of the field problem.

During preparation, judges are to observe the captain and other team members as to their knowledge and proper operation of the self-contained breathing apparatus, gas detecting devices, other respiratory protection equipment to be used, and firefighting equipment, etc.

Judge(s) will be stationed, and must remain, at the fresh air base when telephones or mine rescue communication systems are being used.

As each team performs a problem, it will be rated by a crew of three or more designated judges. Only the Contest Director, Chief Judge, or their designee may discuss discrepancies or discounts on the field. When discussions are held on the field, that interrupt the working of the problem, the time should be stopped and restarted after the discussion is over. A Mine Safety and Health Administration employee will be the No. 1 Judge. All judges must have current Mine Rescue Judge's Training and have been briefed on this particular problem and possible solutions.

The judges will mark and explain on their score cards the discounts for work performed by each team member. In the event that more than one discount applies, the highest discount will be assessed for a violation. There will be no "stacking" of discounts. Judges must sign their score card after the discounts have been recorded. Score cards will be marked promptly and delivered to score card examiners as soon as possible after completion of the problem, and the team's review of the team's field discounts.

Security

Each team, including the alternate and the person used at the fresh air base, must be under guard before the start of the contest, in a location assigned by the Chief Judge, and must remain continuously under guard until time to work the problem. Any team receiving information concerning a contest problem will be disqualified. No person except guards and contest officials authorized to do so, will be allowed to communicate with any team or teams under guard. Teams that have performed will not be permitted to communicate with any teams awaiting their turn to perform.

Contest Problem

The problem will be limited to working on one level. It may include hoists and at least one shaft. Skip pockets and sumps (either above or below) will be considered part of the working level. Raises or boreholes may be in the problem; however, climbing will not be required.

Teams may have to change existing ventilation, pump water, or move falls to rescue persons and/or explore if it can be done safely. Changing ventilation shall not be done until the effects

have been discussed with the fresh air base. Ventilation changes will be considered as starting, stopping, or redirecting the air current. If existing check curtains are to be used to direct ventilation, the check curtain must first be converted into a temporary stopping.

All areas that have been cleared of smoke and toxic or dangerous gases that the teams elect to travel through must be rechecked prior to the team's reentering. If water is being pumped, ventilation changed, falls moved, loose rock barred down, etc., teams must wait until placards have been changed by the ground committee before assuming they have accomplished what they were trying to do.

Inaccessible areas only need to be explored when there are miners unaccounted for or an explosive air/gas mixture may be moved through the unexplored areas. Teams will be required to pump water or set timbers to explore the inaccessible areas in these cases, if the necessary materials are provided in the problem.

Only judges, contest officials, escorted photographers, and news media approved by the Contest Director or Chief Judge will be permitted in the working areas.

Insofar as possible, materials rather than placards will be used in the mine. Bodies with identification will be designated by the use of dummies. When placards indicating conditions are used, they will be placed face up, and the letters shall not be less than one (1) inch in height, and easily visible.

Additionally, when these placards are used to identify mining machinery or equipment, a photocopy of a picture of such machinery or equipment shall be on the placard, when possible, to aid teams in identifying it.

Terms used in the problem shall generally be terms which appear in the Rule Book Glossary, the MSHA Mine Rescue Training Modules, or CFR 30, Part 57. If a term is unfamiliar, the captain may ask the No. 1 Judge for a definition of that term.

When raises, winzes or boreholes are in the problem, the card identifying them will indicate whether they go up and/or down from the level.

TEAM PREPARATION AND PROCEDURES

The team members should be knowledgeable in mine rescue preparation and procedures.

Apparatus and Material Checks

Before reporting to the contest field, each team member should check his/her own apparatus to see if it is charged properly and in good working condition. These checks should be within the manufacturer's specified limits and the regenerator fully charged with chemicals. Apparatus tightness, valves, warning devices, and facepieces are to be checked according to approved methods for the particular apparatus. The extra breathing apparatus should also be tested accordingly. Teams will not be judged on this procedure.

Other materials such as roof testing devices, stretchers, hammers, blankets, fire extinguishers, and gas detectors should be carefully checked to see that they are in good operating condition. If horns are to be used for signaling between team members, they should be checked. If communication systems are used, a check for proper working order should be made. Wheeled stretchers will be allowed.

Briefing

When all members of the team have their apparatus fully assembled and ready to wear, the captain should assemble the team and report to the Briefing Station Official when directed by the guard. The team will be briefed on field conditions either by a video or a briefing paper. The briefing should contain all pertinent information, including the following conditions: classification of the mine; frequency of explosive gas being found; accuracy of the mine map; possibility of the mine being cut into another mine; condition of the fan; have guards been posted; electric power cut off from the mine or affected parts of the mine; recovery work that has been accomplished; notification of the local, state, and federal agencies; reserve rescue teams, equipment and materials that are available.

Any final adjustments to the equipment and necessary talks between team members can be completed prior to reporting to the field judge.

Reporting to Field

On reporting to the field, the captain should have the team line up at the place indicated by the person in charge. No testing of any type should be done at the fresh air base until the timing device has been started. Leaving the stretcher, the captain should gather his team (apparatus may be worn but not under oxygen) and approach the person in charge for introductions. The captain introduces his team and remarks "We are here to offer our help. I have a fully equipped, properly trained, and physically fit mine rescue team and we are ready to do anything that you may require in the rescue and recovery work at your mine." The official in charge will reply that they do require the service of mine rescue teams, and that if they are ready, they can be of immediate service.

Start of Problem

When the necessary introductions have been made, the team captain will indicate that they are ready for the problem and map. Upon receiving the problem and map, the captain will start the timing device and date the board (month, day, year, and team position number). From this point on, the team members should discuss the conditions presented by the problem and the map. On the map, solid lines will denote actual workings. Although locations may not be totally accurate within the 6 foot map requirement, solid lines will represent known conditions. Dotted lines will denote projections and may or may not be accurate. These conditions should be studied carefully so that proper procedures may be decided in advance.

Official in Charge of Fresh Air Base

The captain should ask to have the person in charge of the lifeline pointed out to the rear captain. Teams using a telephone communications system must inform the person in charge that the telephone line may be used as a lifeline in the event of the system malfunctioning. Lifeline signals with the fresh air base will be arranged after the timing device has been started. The telephone line must be of sufficient strength to satisfy the requirements of a lifeline.

Standard Shaft and Lifeline Signals

The rear captain shall now contact the person in charge of the lifeline. The rear captain will give the accepted signals and have the lifeline person repeat them. The signals in general use are as follows:

- 1 pull on the lifeline will mean for the team to stop if in motion.
- 1 pull on the lifeline will mean that the team is OK, if at rest.
- 2 pulls on the lifeline will mean for the team to advance.
- 3 pulls on the lifeline will mean that the team is retreating.
- 4 pulls on the lifeline from the team to the fresh air base means that the team is in trouble and needs assistance at once. If 4 pulls are given by the fresh air base, the team must return to the fresh air base.

All signals on the lifeline must be returned to the sender at once. The rear captain may now stretch the lifeline out along the length of the team. It is not necessary for the captain to give a command to execute when using a telephone-speaker system since the team members will be aware of all communication.

The following standard horn blasts or other audible signals between team members will be used:

1 blast on the horn will mean for the team to “stop” if in motion

2 blasts on the horn will mean “advance”

3 blasts on the horn will mean “retreat”

4 blasts on the horn will mean “distress”

If signals between team members are other than the standard signals normally used, all interested persons must be informed.

State hoist shaft signals will be used wherever contest is held.

NEVADA HOIST SIGNAL CODES

The conveyance shall not be moved without a command signal. When persons are to be hoisted or lowered, they must enter the conveyance and close the door; then give the signal for the desired level followed by either “Hoist Persons” (3-1 bells) or “Lower Persons” (3-2 bells).

3-2-1 Bells: Blasting Signal; hoisting engineer must acknowledge by raising and lowering conveyance slightly.

9 Bells: Emergency; then ring mine level signal where emergency exists.

MINE LEVEL SIGNALS

Surface Shaft Collar - 1-2 Bells

500 Feet First Level - 2-1 Bells

HOIST SIGNAL

| | |
|-------------|--------------------------------|
| 1 Bell | - STOP |
| 2 Bells | - Lower Conveyance |
| 3 Bells | - Raise Conveyance |
| 3-1 Bells | - Hoist Persons |
| 3-2 Bells | - Lower Persons |
| 3-3-1 Bells | - Hoist Slowly with Caution |
| 3-3-2 Bells | - Lower Slowly with Caution |
| 1-2-1 Bells | - Hoist Muck or Materials Only |
| 2-1-2 Bells | - Release Conveyance |

Equipment Checks and Procedures

The stretcher must be tested at the fresh air base and should be tested by supporting the weight of a person wearing an apparatus. The other equipment such as fire extinguishers, gas detectors, flame safety lamps, or, if used, oxygen indicator shall be checked as indicated in the MSHA Contest Rules Book and, if necessary, put into operating condition. The team should also check to see that the other necessary equipment is ready and available. For contest purposes, a one-minute seal check simulating 10 minutes will be sufficient for the Draeger multi-gas detector.

After the clock is started, only the five working team members and the fresh air base attendant will be permitted to do the work at the fresh air base. Only one attendant will be allowed to physically assist the team after the clock is started. Alternates may not participate in any work unless they are used as a replacement for one of the working team members. However, the alternate can communicate with the team from the fresh air base.

Team Safety

Follow established procedures per the MSHA National Contest Rules Book for the type of equipment used when getting under oxygen.

The team captain must now check each member's apparatus. A team member must make the same checks on the captain's apparatus. The judges will observe the operation and adjustment of the apparatus.

The captain should see that the team line is properly stretched out, that the team has the proper interval between each member (5 to 7 feet), and that the team members are holding or are attached to the team line.

If a team encounters smoke, an apparatus check or personnel check is required before entering smoke. In smoke, all team members must have hold of, or be fastened to, a lifeline.

The captain must now have the team count off either orally or visually by the raising of hands.

The captain must give the signal to advance. The stretcher bearers should pick up the stretchers, and the rear captain shall relay the signal to the fresh air base. When the signal is returned, the team may now advance into the mine.

Teams shall never travel through water over knee deep. Entrances to all mine openings shall be examined. This examination should not cover more than 25 feet. In air clear of smoke, these checks may be made without a lifeline, provided the entire team does not go into the entrance.

Checking for loose ground (loose roof or rib) is done visually by the team captain as the team works the problem. The captain must orally warn the team of such conditions as they are encountered.

First Team Stop

After advancing into the mine not more than fifty (50) feet from the cage or portal, the captain shall give a signal for the team to stop. The co-captain may take no more than two steps forward after the horn blast before stopping. The captain now checks the members and their apparatus to see if they are in good condition and a team member checks the captain and his/her apparatus. (This check must not be made on the cage.) The procedure shall be followed at not more than twenty (20) minute intervals while the team is working the problem. Additionally, apparatus removed in order to enter a confined area or apparatus that has sustained possible damage from impact must be checked before continuing.

If all the apparatus are operating properly and the members are in good condition, the team can now continue into the mine.

The cage door must be kept closed after the cage has been unloaded and is in a stand by mode.

Advancing

When stops are made at the openings of crosscuts, rooms, or drifts turned off the drift that is being traveled, separate gas tests should be made across each entry within 25 feet of each opening to the place turned off the entry. No place which intersects entry direction should be passed without first checking the condition of that place; that is, if a room is turned from the entry, that room should be checked before examining the entry beyond the opening. Examination of any room or entry shall not exceed 25 feet from the rear captain. This means the captain can extend out and take gas readings within the limits of the team line.

In case of entries turned from the entry being traveled, it is a matter of choice which entry is to be followed and many things must be taken into consideration in making the choice. However, the openings of all places must be checked before that place is passed. A team will be considered to have passed an opening or intersection when the number 5 member is past the opening.

While advancing, if a team encounters an impassable fall or other condition that prevents the members from following the normal course of travel into an area, they may break a stopping and enter that area. If it becomes necessary to break a stopping, the team shall erect a temporary stopping or stoppings that would have the same effect on the area that the original stopping would have provided. Doors shall not be opened without a prior knowledge of the conditions, unless a temporary stopping has been erected.

Where crosscuts are blocked, no team member may advance more than 3 feet beyond the 2nd intersection before tying across and/or behind into all unexplored areas that intersect. The second intersection will be determined by two crosscuts on either side of the entry being traveled. The first intersection will be the blocked intersection. However, a team will be permitted to tie across to adjacent drifts to tie in behind.

Barricades

If a barricade is found, the team will take action to protect the barricaded persons as indicated by the conditions found outside the barricade. Before the barricade is opened, the entire area of the mine is assumed to be filled with an irrespirable atmosphere unless otherwise specified in the problem, and will require the construction of a reasonably airtight temporary stopping. The space between the barricade and the temporary stopping should be as little as feasible; however, it should be large enough for the team to enter. When entering the barricaded area, the opening in the barricade should be kept to a minimum, the roof in the area shall be tested, and gas tests made. For the purposes of contest work, no barricade will be entered without ventilating in front of the barricade if: Oxygen (O₂) is below 17%; or Carbon Monoxide (CO) exceeds 4000 PPM (0.4%); or Hydrogen Sulfide (H₂S) exceeds 700 PPM (.07%); or Nitrogen Dioxide (NO₂) exceeds 100 PPM (.01%); or Sulfur Dioxide (SO₂) exceeds 400 PPM (.04%); or Carbon Dioxide (CO₂) exceeds 5%. In the event that gases other than these are encountered or indicated by the problem, the team must ask for stain tubes or testing devices for these gases if they don't have them. They must use the proper tubes in accordance with the MSHA training Modules.

If survivors are found, they shall be given proper respiratory protection. If more than one (1) survivor is behind the barricade and proper protection cannot be provided for all of them, the team in retreating should keep the openings in the barricade and temporary stopping to a minimum so that as little irrespirable air will get into the barricaded area as possible. If the area beyond the last survivor can be explored without advancing the survivor, this should be done before retreating with the survivor. When all the survivors have been removed from the barricaded area, the enclosure may be opened as wide as necessary for easy exit. Survivors must be secured to the stretcher and covered with a blanket unless first aid procedures indicate other treatment is proper. If a person is found behind a barricade or in a refuge chamber and the area is not entered, the team may advance beyond the chamber for exploration. However, if survivor(s) can be safely evacuated without changing conditions, they shall be evacuated before any further exploration is done.

Dates and Initials

The date and the captain's initials shall be marked at the point of farthest advance of the team in any direction such as at stoppings, faces of rooms and drifts, water over knee deep, impassable falls, barricades, fires out of control, and at the location of any survivors or bodies.

Map - Timing Device

When the team has covered the assigned territory and the work has been completed, it should return to the fresh air base and count off. After the team checks the map, the captain should present the map to the persons in charge of the mine and stop the timing device. The map person must use the standardized map legend provided in the MSHA Rules Book or write everything out.

The marked map must show: the condition of all faces, stoppings and doors; the location of all

placards or materials; the location of fires and barricades; and the location of dead bodies and survivors (including identification). Temporary stoppings that are erected shall also be shown as well as the location of any gas found or indicated by placards. The map must show all locations dated and initialed by the team captain. If a team fails to explore the entire mine, the furthest point of advance shall be indicated on the map by a line drawn across the entry with "Furthest Point Of Advance" written out.

Mine Fires

When a mine rescue team encounters a noncombustible fire, indicated by "intense heat" or "fire out of control," the team shall, without undue delay, seal the fire, with or without regulators, so as to restrict the air flow to the fire and prevent its further advance. The team must then, without undue delay, find all other approaches to the fire and seal them. This does not preclude systematic exploration of the area. Whether to use seals with or without regulators and when to entirely seal the fire must be decided by the team, after any necessary consultation with the official in charge. This decision will take into consideration the safety of the team and any survivor(s), the classification of the mine (gassy/nongassy), the presence of any explosive gases, the possible effects of any ventilation change(s), and other pertinent data.

Gas Box Testing

Gas testing proficiency will be conducted either prior to or following the mine problem. Gas testing will be judged. The following gases will be tested in each of four boxes in this order: CO, CH₄, NO₂, and low O₂. This test must be taken by competing team members and the sixth member.

The gas-box team will provide three air-gas mixtures. A 4th box contains normal air. Instantaneous instrument readings are used to determine the accuracy of the contestant's reading. Discount points are charged if a contestant does not report gas concentrations within acceptable limits.

Correct gas concentrations will be attained when reported gas concentrations fall within the following ranges:

Oxygen. The range for correct readings will be determined by adding 1% and deducting 1% from the gas-box concentration observed on the analytical instruments being operated by MSHA. For example, if the gas-box concentration is observed to be 19.2%, then correct readings will be in the range from 18.2% (19.2 minus 1) to 20.2% (19.2 plus 1) inclusive.

Methane. The range for correct readings will be determined by adding 0.2 and deducting 0.2 from the gas-box concentration observed on the analytical instruments being operated by MSHA. For example, if the gas-box concentration is observed to be 1.8%, then correct readings will be in the range from 1.6% (1.8 minus 0.2) to 2.0% (1.8 plus 0.2) inclusive.

All other gases using electronic instruments. Correct readings will be within 20% (inclusive) of

the gas-box concentration observed on the analytical instruments being operated by MSHA. For example, if the gas-box concentration is observed to be 140 ppm, then correct readings will be in the range from 112 ppm (0.8 times 140) to 168 ppm (1.2 times 140) inclusive.

Any gas using stain tubes. Correct readings will be within 25% (inclusive) of the gas-box concentration observed on the analytical instruments being operated by MSHA. For example, if the gas-box concentration is observed to be 200 ppm, then correct readings will be in the range from 150 ppm (.75 times 200) to 250 ppm (1.25 times 200) inclusive.

Prior to performing the gas tests, contestants will be tested on proper procedures in using and calibrating their instruments.

Gas Box Scorecard

Team Name _____ Team Number _____

Instruments:

| Gas Box Tests | BOX 1 |
|---------------|-------|
|---------------|-------|

1. Failure to make gas tests in proper order 1 _____
2. Improper procedure when testing with
gas detectors, each infraction 2 _____
3. Failure to determine gas concentration
within the prescribed error rate of the
detector used, each infraction 4 _____

METHANE

| %CH ₄ in box | Min. Accepted Indication | Max. Accepted Indication | % by Examiner |
|----------------------------|-----------------------------|-----------------------------|------------------|
| _____ | _____ | _____ | _____ |

CARBON MONOXIDE

| ppm CO in box | Min. Accepted Indication | Max. Accepted Indication | ppm by Examiner |
|------------------|-----------------------------|-----------------------------|--------------------|
| _____ | _____ | _____ | _____ |

OXYGEN DEFICIENCY

| % O ₂ in box | Min. Accepted Indication | Max. Accepted Indication | % by Examiner |
|----------------------------|-----------------------------|-----------------------------|------------------|
| _____ | _____ | _____ | _____ |

| | |
|--------------------------------|--------------------------|
| _____ Gas Judge's Signature | Total Discounts _____ |
|--------------------------------|--------------------------|

**MINE RESCUE DISCOUNTS AND INTERPRETATIONS
SURFACE DISCOUNT SHEET**

| Judge #1 | Discounts |
|---|------------------|
| 1. Apparatus improperly assembled, each apparatus | 3 _____ |
| 2. Apparatus improperly adjusted to the wearer, each infraction | 1 _____ |
| 3. Failure to follow prescribed procedures for going under oxygen, each person | 3 _____ |
| 4. Apparatus part or parts worn or deteriorated so as to be dangerous to wearer, each person | 8 _____ |
| 5. Failure of captain to examine each apparatus and have captain's examined before entering the mine, each apparatus each infraction | 2 _____ |
| 6. A team member failing to carry identification upon his/her person, each member | 2 _____ |
| 7. Team member not wearing protective clothing, including safety shoes, hard hat, permissible cap lamp, self-rescuer, each infraction | 2 _____ |
| 8. Failure of team captain to mark date and team position number on the check board at mine portal or fresh air base, or start timing device, each omission | 4 _____ |
| 9. Failure to be clean shaven in areas that affect a good face-to-facepiece seal, each infraction | 2 _____ |

| | |
|----------------------------|--------------------------|
| _____ Judge's Signature | Total Discounts _____ |
|----------------------------|--------------------------|

MINE RESCUE DISCOUNTS AND INTERPRETATIONS SURFACE INTERPRETATION

Judge #1

1. This discount will be applied if the team captain or team member does not correct it when the team goes under oxygen.
2. Shoulder straps, chest straps, etc., that are twisted or not fastened. (Separate discount for each strap.) This discount will be applied if the team captain or team member does not correct it when the team goes under oxygen.
3. This will depend on type of apparatus used; the proper procedure will be outlined in the apparatus section. Once the team has entered the course, no further penalties can be assessed by the judges for items 1, 2, 3.
4. Holes in the breathing tubes or straps worn to the extent that they break during working of the problem while still at the fresh air base, should not be discounted if they are replaced prior to starting work in the mine.
5. The captain must examine the apparatus of team members and have a team member examine the captain's apparatus before entering the mine. The person making the check must obtain assurance from person being checked that he/she is all right (asking if person is okay will suffice).
6. Metal tag on member's belt with name and employee identification number in addition to the team member's number on arm at or near the shoulder. Number on hat or cap lamp is not acceptable.
7. All equipment must be permissible and operating before advancing into the mine. In the event of an equipment failure other than a SCBA, the team will fix it, use the back-up, or return to the FAB to replace the failed equipment.
8. Captain must mark date and team position number on check board after clock is started, and the captain must stop the clock after the map is turned in.
9. Self-explanatory.

MINE RESCUE DISCOUNTS AND INTERPRETATIONS UNDERGROUND DISCOUNT SHEET

| Judge #1 | Discounts |
|---|-----------|
| 1. Breathing external air while working problem, each team member, each infraction | 10 _____ |
| 2. Team not following proper procedure in case of apparatus failure, each infraction | 10 _____ |
| 3. Failure to use posted hoisting signals, each infraction | 1 _____ |
| 4. a. Failure of the captain to indicate to the team he/she has recognized bad ground. b. Failure of the captain to verbally indicate he/she is checking the back or roof; 1. at intersections, shaft stations, rooms, faces, and mine openings; 2. at all points of farthest advance; 3. before building or erecting any structure; 4. upon passing through any barricade, stopping, bulkhead, air lock; door; check curtain, or similar barrier; 5. at the location of fire or intense heat. c. Any team member performing work or moving into any part of an area during a team stop before the captain has visually checked the ground conditions in that part, each infraction (6 points maximum) d. Failure to close shaft station gate | 5 _____ |
| 5. Failure of the captain to mark the date and his/her initials at the point of farthest advance of the team in any direction such as at stoppings, faces of rooms and drifts, water over knee deep, impassable falls, barricades, fires out of control, and at the location of any live persons or bodies, each omission (maximum 10 discounts) | 2 _____ |
| 6. Failure of team to stop within 50 feet of the fresh air base or at the shaft station to perform personnel and apparatus checks, upon their first entry into the mine. | 4 _____ |
| 7. Team member(s) not making apparatus check after removing apparatus to traverse restricted clearance or after apparatus has sustained possible damage from impact (total team discounts, each incident) | 4 _____ |

8. Captain or other team member doing anything to endanger himself/
herself or other team members, 15 points each team member so
endangered, each infraction, each occurrence 15 _____
9. Failure of team to explore or examine workings systematically and
thoroughly, each omission 4 _____
10. Teams must be checked immediately before entering smoke 5 _____
11. Failure to locate, seal or extinguish fire, if possible, without undue delay 8 _____
12. Failure to examine apparatus at not more than 20-minute intervals.
Each minute or fraction thereof (maximum 5 discounts per incident) 1 _____
13. Any act by the team which may result in an explosion of an explosive
air/gas mixture. 30 _____

Total
Discounts _____

Judge's Signature

MINE RESCUE DISCOUNTS AND INTERPRETATIONS UNDERGROUND INTERPRETATION

Judge #1

1. Working all or part of problem without a facepiece or working with inhalation hose disconnected.
2. Proper procedure would depend on type of apparatus; however, team must proceed to fresh air base immediately.
3. Hoist shaft signals will be posted at shaft stations and will be used to notify the hoistman of intended movement.
4.
 - a. Must so indicate before any other team member passes the placard. This applies each time such a placard is reached; when retreating the rear captain must do this.
 - b.
 1. Must be so indicated before physically entering the area.
 2. Includes checking in front of any physical barrier to advancement.
 3. Including erecting or breaching stoppings, barricades, curtains, etc.
 4. Must be so indicated before physically passing through.
 5. Must be so indicated immediately upon reaching the placard indicating fire or intense heat.
 - c. This means the captain's physical presence is necessary before any part of an area can be considered as having been examined.
5. Such places only need be marked once and so marked must be indicated on the map. Date means month, day, and year.
6. This check must be made:
 - a. at the first stop, with all team members past the portal, or off the cage (this does not apply to checking mine entrances prior to working the problem);
 - b. before the captain exceeds 50 feet from portal or shaft, and before the team leaves the shaft station.
7. This apparatus check must be made as soon as all team members have passed through the restricted area and before any other work is done. Additionally, this apparatus check must be made immediately after any apparatus has sustained a blow which might cause damage to it.
8. Examples of endangerment include, but are not limited to:
 - a. 15 points will be assessed for each team member who:
 1. travels under bad roof or ground;
 2. travels into and through water over knee deep;
 3. travels over or under an open ore pass or ore pocket into which they could fall or be injured by falling objects;

4. advances past a sign indicating intense heat or fire out of control;
- b. The entire team will be considered endangered and 75 points assessed for:
 1. failure to check a shaft for possible damage, or the presence of fire or flooding, prior to traveling through it. For contest purposes, this check may be done by placing combustible materials on the cage and having the cage lowered to the level to be explored, then raising it to the collar;
 2. not using non-sparking tools in a gassy mine or when explosive gases are found in a non-gassy mine.
9. This will be assessed for not exploring all areas of the mine that can be explored without endangering team, if problem requires entire mine to be explored, or leaving accessible areas that can be safely explored without removing permanent stoppings. All accessible areas must be tied across and behind before advancing. Where crosscuts are blocked, no team member may advance more than 3 feet beyond the second intersection before tying across and/or behind into all unexplored areas that intersect. This may require building an air lock or returning to the fresh air base and exploring into other drifts at the discretion of the team and according to conditions of the mine. Shafts must be checked for possible damage, water, or fire, and must be traveled to be considered explored. All shafts must be traveled, if possible, before proceeding beyond the 2nd intersection.
10. Personnel checks, not necessarily an apparatus check. The person making the check must obtain assurance from person being checked that he/she is all right (asking if person is all right will suffice).
11. Sealing or fighting a fire does not relieve the team of the responsibility of systematic exploration.
12. One point for each minute or fraction thereof (total discounts not to exceed 5 points).
13. Each infraction:
 - a. Changing conditions of the mine ventilation system in such a manner that an explosive mixture is moved over an ignition source.
 - b. Continuing exploration after conditions are found to indicate an imminent explosion is possible by the presence of an explosive mixture and the evidence of fire (smoke or carbon monoxide) and the location of the fire is unknown. A team must continue to explore if it knows there is a continuous nonexplosive separation between the explosive mixture and the evidence of fire.
 - c. Changing conditions of the mine ventilation system in such a manner that an explosive mixture is moved over an unexplored area. If a team explores all sides of a overcast or underact, both ends of a ventilation shaft, or the top and bottom of shafts when the shaft cannot be traveled, the in-between areas are considered explored for ventilation purposes.
 - d. Utilizing electric or battery-powered equipment in a potentially explosive air/gas atmosphere. For contest purposes, a potentially explosive atmosphere would be an

air mixture containing over 1% methane (CH_4). It would also include any other air/gas mixture which has a reasonable potential to reach an explosive range. Ignition sources would include any communication device, unless designated as sound-powered or intrinsically safe.

**MINE RESCUE DISCOUNTS AND INTERPRETATIONS
SURFACE DISCOUNT SHEET**

Judge #2

Discounts

- | | | |
|----|---|---------|
| 1. | Failure to take necessary equipment and gas detecting devices to work the problem, each omission | 4 _____ |
| 2. | Failure to have equipment and gas detecting devices ready for testing and failure to properly test each piece of equipment, including stretchers, each omission | 2 _____ |
| 3. | Gas detectors, testers, and/or indicators failing to function properly upon testing. If not corrected before entering the mine, each infraction | 2 _____ |
| 4. | Failure to secure extra apparatus to stretcher, each omission | 4 _____ |
| 5. | Testers or detectors improperly assembled or defective parts used | 8 _____ |

Judge's Signature

Total
Discounts _____

MINE RESCUE DISCOUNTS AND INTERPRETATIONS SURFACE INTERPRETATION

Judge #2

1. Failure to take necessary equipment or testing devices underground, discount should be assessed even if teams return to fresh air base to pick up necessary equipment.
2. All equipment and gas detecting devices must be checked; however, fire extinguishers need not be activated a visual check will suffice. Proper test of gas detecting devices will be determined by the type used and the procedure outlined in the MSHA Contest Rules Book. Proper stretcher tests means lifting the stretcher with team member wearing apparatus, lying prone on stretcher. (All this must be done after clock is started.)
3. Faulty equipment must be repaired or replaced.
4. Extra apparatus must be secured to stretcher to prevent it from falling off.
5. If any questions exist, the equipment should be checked by the judges after the completion of the problem in the presence of the team captain.

**MINE RESCUE DISCOUNTS AND INTERPRETATIONS
UNDERGROUND DISCOUNT SHEET**

| Judge #2 | Discounts |
|---|------------------|
| 1. Failure to make necessary gas tests where required, each omission | 1 _____ |
| 2. Improper procedure when testing with gas detectors, each infraction | 2 _____ |
| 3. Intentional causing of a test instrument to inflate faster than tests indicate that it should, each infraction | 1 _____ |
| 4. Traveling at more than a normal walking speed | 8 _____ |
| 5. Team member talking to an unauthorized person without permission of the judges or supervisors, each infraction | 5 _____ |
| 6. Failure to erect temporary barricade when necessary, each infraction | 10 _____ |
| 7. Failure to erect temporary barricade seal or stopping reasonably airtight, each infraction | 2 _____ |
| 8. Less than 5 members entering, working or completing problem, each person | 8 _____ |
| 9. Any team passing a card indicating a condition in the mine before determining the information on the card, each infraction | 2 _____ |
| 10. Failure to make necessary ventilation changes or changing ventilation or electric power before the effects of such changes are known, each infraction | 15 _____ |

Judge's Signature

Total
Discounts _____

MINE RESCUE DISCOUNTS AND INTERPRETATIONS UNDERGROUND INTERPRETATION

Judge #2

1. Tests for gases must be made at face areas and stoppings. When stops are made at the openings of crosscuts, rooms, or drifts turned off the drift that is being traveled, separate gas tests shall be made rib to rib across each entry and each opening to the places turned off the entry. No place shall be passed without first checking the condition of that place. That is, if a room is turned from the entry, that room shall be checked before examining the entry beyond the opening. This does not necessarily hold true in cases of entries. In cases of entries turned from the entry being traveled, it is a matter of choice which entry is to be followed and many things must be taken into consideration in making the choice. However, the openings of all places must be checked before that place is passed. A team will be considered to have passed an opening or intersection when the No. 5 member is past the opening.
2. This will depend on type of instrument used. Improper procedure when testing includes the location of the instrument when testing or using a gas detection device beyond its limits or range. For example, a methane detector must be held overhead when testing because methane (CH_4) is light and will be found in high places near the back or roof. Nitrogen dioxide (NO_2) is relatively heavy and will be found in greater concentrations along the floor and in low places. Therefore, this test must be made with the tester below the waist. Carbon monoxide (CO) is slightly lighter than air so this test must be made at chest height.
3. Self-explanatory
4. Teams traveling obviously faster than a normal walk (a majority of judges must concur on this) shall be discounted.
5. Do not hesitate to assess this discount; however, explain and name unauthorized person on discount card and state instructions given if known.
6. Where conditions are unknown, stoppings, doors and barricades require construction of temporary stopping by a team before a team may make openings in the pre-existing stoppings, doors, etc. This does not apply to existing check or drop curtains used to direct the air current. When retreating out of a barricade or coming back through a stopping where an air lock has been erected it will not be necessary to air lock on the way out if this will not change any existing ventilation.
7. Temporary barricade seal or stopping must be fastened at top, sides, and bottom. Simulating fastening a barricade is not acceptable. Air curtains that have to be upgraded to temporary stoppings, such as a curtain that directs airflow, require additional material such as a 2 by 4 on the bottom of the curtain and nailed to make a good seal.

8. This does not apply to checking mine entrances prior to working the problem.
9. Means if all five team members pass the card.
10. Teams must confer with the official in charge before changing the ventilation or electric power and such things as explosive gases and the safety of trapped miners and rescue personnel must be considered. Teams do not have to exit the mine to change power or ventilation if they can inform the FAB by approved communication devices available. Conversing with the FAB does not relieve the team of the responsibility of their decision.

**MINE RESCUE DISCOUNTS AND INTERPRETATIONS
SURFACE DISCOUNT SHEET**

Judge #3

Discounts

- | | | |
|----|---|----------|
| 1. | Failure to test the communication system or arrange with judges the signals to be used | 3 _____ |
| 2. | Failure to give proper notification with lifeline or communication system of team's intentions, each infraction | 2 _____ |
| 3. | Failure to connect phone when applicable before entering the mine | 2 _____ |
| 4. | Failure to take lifeline or wire communication system into the mine | 10 _____ |
| 5. | Failure of team to "count off" before entering or leaving the mine | 2 _____ |

Judge's Signature

Total
Discounts _____

MINE RESCUE DISCOUNTS AND INTERPRETATIONS SURFACE INTERPRETATION

Judge #3

1. Standard horn blasts or other audible signals between team members will be used:
1 blast - "Stop" if traveling or "All Right" if at rest
2 blasts - "Advance"
3 blasts - "Retreat"
4 blasts - "Distress"
2. Failure to notify fresh air base with phone or lifeline of team's intentions would include advancing or retreating team prior to giving signal or notifying fresh air base and receiving reply. When advancing, and captain gives signal to stop, No. 5 member may not move more than 2 steps. If team is stopped and captain gives signal to retreat or advance, the No. 5 member must await return signal prior to starting to move. The No. 5 member may move from side to side to give captain more area when team is connected by lifeline in smoke or by telephone line as long as he/she does not pull or give line. All team members must hold or be attached to the lifeline at all times while traveling and team members shall be no more than 7 feet apart. If taglines are used between team members and the team line, they shall be no longer than 3 feet in length. Do not apply this to movement at the fresh air base.
3. Self-explanatory.
4. This would apply only if all team members were in the mine.
5. This can be done at any time after the clock is started but must be done prior to team entering the mine. It does not have to be done prior to checking portals. Hand or audible counting off is acceptable. It is not necessary to count off upon reentry or leaving mine; however, the team is also required to count off when completing problem.

MINE RESCUE DISCOUNTS AND INTERPRETATIONS UNDERGROUND DISCOUNT SHEET

| Judge #3 | Discounts |
|--|------------------------|
| 1. Failure to properly secure survivor to stretcher; failure to cover survivor with blanket (unless first aid procedures indicate otherwise); or placing survivor on stretcher in such a way as to foul proper operation of apparatus, each omission | 4 _____ |
| 2. Survivor care: a. Failure to adequately examine and assess each person found in the mine for possible injury or illness, each infraction b. Failure to properly treat any injury or illness which is, or should have been, revealed by the examination, each infraction | 4 _____ 4 _____ |
| 3. In smoke, any team member not having hold of lifeline, or not having it firmly attached to his/her person, each infraction | 2 _____ |
| 4. In clear air, none of the team members having hold of lifeline, each infraction | 2 _____ |
| 5. Intentionally detaching/severing lifeline | 5 _____ |
| 6. Failure to bring live person to surface or fresh air base by the end of the problem, each omission | 10 _____ |
| 7. Failure to locate bodies, each omission | 10 _____ |
| 8. Failure to find live persons, each omission | 10 _____ |
| 9. Failure to properly protect live person or persons, each person | 10 _____ |
| 10. Failure to follow proper procedure when putting apparatus on survivor, each infraction | 5 _____ |
| 11. Assistance given by supposedly unconscious person, each infraction | 5 _____ |
| 12. Transporting survivor in unexplored territory, leaving survivor unattended, and moving survivor in any direction except toward the fresh air base, each infraction | 6 _____ |
| 13. Improper signaling with lifeline, if method if not corrected, each infraction | 1 _____ |

14. The team performing an act that results in the death or injury of a patient. Examples of this would be:
- a. Entering a barricade with toxic gases outside.
 - b. Directing toxic gases over a survivor through a change in ventilation
 - c. In the case of multiple survivors, leaving the higher priority patient and taking a less injured patient out, each infraction
 - d. Improperly protecting a survivor from toxic gases 50 _____
15. Failure to notify the fresh air base of an explosive gas. 10 _____

Judge's Signature

Total
Discounts _____

MINE RESCUE DISCOUNTS AND INTERPRETATIONS UNDERGROUND INTERPRETATION

Judge #3

1. Survivor shall be secured to stretcher by at least two bandages or straps, one around trunk of body and one around legs, covered with blanket, and placed so as not to crimp air hoses. (Hands of unconscious person must be secured.)
2. This will be based on the current MSHA First Aid Book (published in 1988) and MSHA Mine Rescue Training Module 2206 "Rescue of Survivors and Recovery of Bodies." (This book may be ordered from the National Mine Health and Safety Academy. See page 9.) A team must deal with a victim(s) if there is either visual or verbal contact if the rescue can be done without violating procedures. Visual contact requires the captain's presence in the area. Verbal contact is any voice communication from the victim that can reasonably be expected to be heard by the team.
3. Applies to any smoke. All team members must be in air clear of smoke before any team member drops lifeline. This discount can be assessed when checking entrances or portals. Any part of a team member (hand, etc.) in smoke, team member is in smoke.
4. Self-explanatory.
5. Self-explanatory.
6. Self-explanatory.
7. Self-explanatory.
8. Self-explanatory.
9. Among other things, using an auxiliary self-contained breathing apparatus or self-rescuer on a live person instead of an approved 2-hour, 3-hour, or 4-hour self-contained breathing apparatus is a failure to properly protect that survivor.
10. Self-explanatory.
11. Applies to person sitting up unassisted or moving arms so as to help in putting on apparatus. (Only applies if person is member of the team and not an MSHA employee.)
12. If a person is found behind a barricade or in a refuge chamber in a contaminated area, and the barricade or refuge chamber is not entered, the team may advance.
13. Improper signals would apply only to signals transmitted between the No. 5 team member and the fresh air base.

14. An act which does not endanger the team but kills or injures the patient(s).
15. Failure to notify the fresh air base when:
 - a. an explosive air/gas mixture is encountered.
 - b. an explosive gas (any concentration) is encountered in a non-gassy mine.

**DISCOUNT SHEET
WRITTEN EXAMINATION**

Company Name:

Team Name:

Draw Number:

Discounts

For each incorrect answer for each person

No. 1 person

No. 2 person

No. 3 person

No. 4 person

No. 5 person

No. 6 person (substitute)

| |
|-------|
| _____ |
| _____ |
| _____ |
| _____ |
| _____ |
| _____ |
| _____ |

Total
Discounts _____

Judge's Signature

Map

Failure to record information on map

OR

Not recording information accurately on
map (within 6 feet of actual location mea-
sured from the center point of the object),
each infraction

1 _____

Total
Discounts _____

Map Examiner's Signature

TIME

Total Time

Total time will be rounded off to the next highest minute. (Total average time will also be rounded off to the next highest minute.)

Discounts

For each minute over average time. A pro-rated part of 50 discounts if team is stopped because of a time limit.

$\frac{1}{2}$ _____

Team No. _____

Total
Discounts _____

Timekeeper's Signature

GAS BOXES

1. Failure to make gas tests in proper order 1 _____
2. Improper procedure when testing with gas detectors, each infraction 2 _____
3. Failure to determine gas concentration within the prescribed error rate of the detector used, each infraction 4 _____

Total
Discounts _____

Gas Judge's Signature

BENCHMAN'S CONTEST

GENERAL RULES

1. One benchman will be allowed for each team entered in the Mine Rescue Contest, unless approved by the Contest Director.
2. Registration will be made with the team registration.
3. Each Benchman's Contest participant shall take the same number as that drawn by the team he/she represents. No switching of numbers will be allowed.
4. Novice Benchman will compete first in order to allow them the opportunity to observe other benchman, upon their approval.
5. The Benchman's Contest will be held on the day after the Mine Rescue Field Competition at a designated location and time. All testing will be conducted at the same time. Contestants will remain in isolation until they finish the bench competition or they will be disqualified. The location of the competition will be noted. The Contest Director may waive this provision if warranted by extenuating circumstances.
6. The bench contestants will be provided with one fully assembled BG-174A, an RZ-25 tester, defogging solution, leak detector fluid and all parts necessary to complete the problem(s). Only tools, apparatus and testing equipment provided by the judge will be used by contestants to work the problem.
7. Total discounts of the written and monthly apparatus checks/problem diagnosis will determine the winner. In the event of a tie, total time will be the first tie breaker. The written test will be the second tie breaker. Third tie breaker will be the time to find the first bug, and each succeeding bug thereafter.
8. At pre-designated time after the written test a five minute review of test answers will be conducted by the test judge. All appeals must be in writing and submitted within one hour of the five minute review.
9. The bench appeals committee ruling will be final.
10. When an unplanned deficiency is encountered in the apparatus, the contestant will be notified by the judges that the deficiency is not part of the problem. The Judge will stop the clock and correct the deficiency.
11. A trophy will be awarded for first, second, third, fourth, fifth and sixth place in the Benchman's Contest.

WRITTEN TEST

1. The written test will be given while the contestants are in isolation and will consist of twenty-five true/ false, multiple choice questions. The questions will be taken from MSHA Training Module 2004. The contestant will be assessed two discount points for each incorrect or unanswered question. Any alterations to the test questions or answers will be determined to be incorrect by the test judge and discounts assessed.
2. Scoring of the test will be completed by at least two qualified judges.

MONTHLY APPARATUS CHECKS/PROBLEM DIAGNOSIS

1. Monthly checks must be performed in order from the exhalation valve test forward and recorded. If and when deficiencies are encountered, contestants must call out to the judge and properly correct and record any and all deficiencies. Visual, high and medium pressure leak checks may be performed at any time during the 30 minute time limit.
2. Hoses must be connected to the RZ-25 Tester and the breathing apparatus prior to any work other than visual. Hoses and mask must be connected to the apparatus with cover on prior to stopping the clock.
3. Contestants may return to correct any uncorrected deficiencies within the time limit. The monthly apparatus checks will be those found on page 135 of MSHA Training Module 2004. The Oxygen Control Assembly Number and the Demand Valve Assembly Number will not be required to be recorded.
4. If contestants perform checks out of order, there will be a one time discount of five (5) points assessed.
5. If checks are performed incorrectly, checks will be discounted as not performed. For example: exhalation test performed with dial on RZ tester set on positive.
6. 30 minutes will be allowed to complete all checks, record and correct any and all deficiencies. There will be a five (5) minute warning by the judge to indicate time limit. At the end of 30 minutes, if contestants have not identified all deficiencies, contestants will be assessed (5) five discount points for each bug not found.
7. Three discounts will be assessed for each problem not found.
8. Two discounts will be assessed for each problem not corrected.
9. Five discounts will be assessed for each monthly check not performed.

10. Sucking or blowing on valves with one's mouth while making checks is prohibited. There will be a 10 point discount assessed for each infraction.
11. At completion, the contestant must have the apparatus fully assembled with hoses to face piece and attached to unit draped over the cover (ready to wear).

JUDGING

1. All judges must have a Level 2 Bench Training Certificate as per described by Draeger.
2. Judges must stand clear of the contestants.
3. Prior to and between each contestant the judges shall perform monthly apparatus checks and correct any and all unplanned deficiencies.
4. When unplanned deficiencies are encountered, judges shall stop the clock, instruct contestants to turn his/her back to the bench area, at which time the judge will correct the deficiencies(s). Judges shall instruct contestants that upon turning back to face the apparatus the clock will start.
5. After completion of the Monthly Apparatus Checks/ Problem Diagnosis there will be a five minute review at which time the judge will discuss discounts. After review both judge and contestant will sign the judge's scorecard. **(See example)**

Team No. _____

Benchman's Contest Judges Working Scorecard

| | | |
|--|--|---------------------------------|
| APPARATUS SERIAL # | | Bench Person _____ |
| Test Date | | Company _____ |
| Visual Inspection | | |
| Cylinder Pressure | | Time _____ |
| Canister/Regenerative, Refillable filled Fact. Sealed? Exp? | | 0 Bug _____ |
| Facepiece and Hoses | | 1st Bug _____ |
| Exhalation Valve | | 2nd Bug _____ |
| Inhalation Valve | | 3rd Bug _____ |
| Relief Valve (opens +10 to +40 mm) | | 4th Bug _____ |
| Pos. Pres. Leak Test | | 5th Bug _____ |
| Neg. Pres. Leak Test | | Time to Complete Problem |
| Preflush | | Min _____ Sec _____ |
| Gauge Equalization | | Discounts |
| Breathing Bag Volume Test | | _____ |
| Lung Demand Valve | | Written _____ |
| By-pass | | Monthly _____ |
| Dosage Test (1.4 to 1.7 mbar) | | Bugs not found _____ |
| Whistle Activation | | Bugs not corrected _____ |
| Whistle Duration (20 to 60 seconds) | | Total Discounts _____ |
| Pres. Gauge Shutoff | | |
| High & Med. Pros. Leaks | | |
| Test OK (initials) | | Judges _____ |
| Replacement Parts | | Bench Person _____ |

ANY TESTS LEFT BLANK -

5 DISCOUNTS _____

Test not performed in order -

5 Discounts _____

Visual and High & Medium pressure leaks can be performed at any time.
All tests shall be conducted in order starting with Exhalation Valve test
Any test not performed correctly will be considered as not being performed.

Team No. _____

Benchman's Contest

[illegible]

DRAEGER TESTING PROCEDURE

| STEP | TESTER SETTING | PROCEDURE HINTS |
|---|-----------------------------|---|
| 1. Visual Inspection | | Check for good condition. |
| 2. Insert O ₂ Cylinder | | Fully charged |
| 3. Insert Regen. Canister | | Factory-sealed for rescue/ refillable for training |
| 4. Facepiece and Hoses | | Check for good condition. |
| 5. Exhalation Valve | Zero Adjust → | Cap off exhalation hose. Connect inhalation hose to exhalation valve. |
| | Neg. Pres. Pumping → | Bag should not begin to deflate tiers seconds |
| 6. Inhalation Valve | | Connect inhalation hose to inhalation valve (saliva trap should be vertical). |
| | Pos. Pres. Pumping → | Bag should not begin to inflate after 5 seconds. |
| 7. Relief Valve Alternate Relief Valve Test (Per- formed after Step 10) | | Connect exhalation hose to exhalation valve. |
| | Pos. Pres. Pumping → | Fill bag. Relief valve should open between +10 and +40mm (+1 and +4 mbar). |
| 8. Pos. Pres. Leak | Pos. Pres. Pumping → | Plug relief valve and whistle. |
| | Leak Test → | Pump up to +100mm H ₂ O (+10 mbar). Bleed needle down to +70 mm H ₂ O (+7 mbar). Start stopwatch, observe meter for 60 seconds. Should not drop more than 10 mm H ₂ O (1 mbar). |
| 9. Neg. Pros. bak | Neg. Pres. Pumping → | Remove plug from relief valve only. |
| | Leak Test → | Pump down to -100 mm H ₂ O (-10 mbar). Bleed needle up to -70 mm H ₂ O (-7 mbar). Start stopwatch observe meter for 60 seconds. Should not drop more than 10 mm H ₂ O (1 mbar). |

| STEP | TESTER SETTING | PROCEDURE HINTS |
|--|---------------------------------------|---|
| 10. Preflush/Pres. Gauge Equalization | Neg. Pres. Pumping → | Remove plug from whistle. |
| | Neg. Pres. Pumping and Leak Test → | Open O ₂ cylinder valve. Bag should completely inflate. |
| Alternate Relief Valve Test | | Compare gauge readings. |
| | | Open cylinder valve. Relief valve should open between +10 and +40 mm H ₂ O (-1 and -4 mbar). |
| 11. Lung Demand Valve/Breathing Bag Volume | Neg. Pres. Pumping → | Pump and count strokes. Should beat least 10 strokes before demand valve opens. Valve should open between -10 and -40mm H ₂ O [-1 and -4 mbar). |
| 12. By-pass/Constant Dosage | Red Dosage Test (0.5 to 2 LPM) → | Plug relief valve vent Press by-pass valve until needle reads 1.7 LPM on outside red scale. Needle should settle between 1.4 and 1.7 LPM (at sea level). |
| 13. Whistle Activation | | Remove plug from relief valve vent. Close O ₂ cylinder valve. Observe chest gauge. Whistle should sound at 20 to 25 percent of full cylinder pressure. |
| 14. Whistle Duration Pres. Gauge shutoff | Neg. Pres. Pumping → | Lift pressure gauge shutoff Open O ₂ cylinder valve. Start stopwatch. Whistle should sound for 20 to 60 seconds. Chest pressure gauge should read zero. Return shutoff valve to down position. |
| 15. High and Med. Pres. Leak | | Cylinder valve still open. Check for leaks. Shut off valve after test. |

PROCEDURES FOR GETTING UNDER OXYGEN AND QUESTIONS AND ANSWERS ON THE VARIOUS APPARATUS



DRAEGER BG-174, 174A BREATHING APPARATUS

Procedures for Getting Under Oxygen:

(1) Open cylinder valve fully. (2) Don the facepiece by pressing the chin against the chin support; pull the facepiece up into position; then, pull the harness over the head. Tighten the neck straps. Tighten the temple straps next. (3) Tighten the top straps last. It is essential that the facepiece fit well. A badly fitting facepiece not only endangers the wearer by the possible inward leakage of contaminated air but also shortens the period of use of the apparatus by allowing the escape of oxygen from the closed circuit. (4) Check the facepiece tightness by tightly closing both breathing tubes and inhaling. The facepiece should collapse against the face, indicating no leaks. Maintain the tubes closed and exhale slowly and forcibly into the facepiece. Significant pressure should build up in the mask before leaking between the facepiece and the face indicating a good facepiece seal. (5) Check the pressure gauge to see that a sufficient oxygen supply remains. Press by-pass valve momentarily and observe the chest gauge. If the pressure drops and the whistle blows, the O₂ group is restricted and the unit is not in a useable condition. (6) Each team member and apparatus should be rechecked by the team captain. The team captain and apparatus should be rechecked by a team member.

Items to be Checked Prior to Going Underground and at 20-Minute Intervals:

- (1) Visually check apparatus.
- (2) Check gauge.
- (3) Question member as to member's ability to continue.

MINE RESCUE QUESTIONS DRAEGER BG-174 AND 174A APPARATUS

All questions are taken from MSHA Training Module Number 2004.

1. The vacuum required to cause the demand valve to begin functioning is between minus 15 and minus _____ millimeters water gauge.
2. The constant-flow system consists of a metering nozzle or drilled orifice which delivers a

constant flow of oxygen to the wearer at a rate of:

- a. 1.5 liters per second
- b. 1.9 liters per minute
- c. 1.3 liter per second
- d. None of the above

3. The pressure reducer within the regulator assembly reduces the high pressure of the oxygen from the cylinder to a working pressure of approximately 57 psi.

_____ TRUE FALSE _____

4. The safety cap on the oxygen cylinder contains a frangible copper disk which will rupture and provide for the escape of oxygen if the cylinder is exposed to excessive _____ or pressure.

5. The corrugated breathing tube assembly has a cooling attachment or may have a saliva trap located on the exhalation hose.

_____ TRUE FALSE _____

6. A lever arm which, during wearing of the apparatus, is secured in the horizontal open position by a wire and lead seal can be rotated upward 30 degrees thereby closing:

- a. Reducing valve
- b. Cylinder shutoff valve
- c. Pressure gauge shutoff valve
- d. Preflush valve

7. If the wearer of the Draeger apparatus dons the apparatus and closes off the inhalation tube, inhales, and the facepiece collapses, this indicates that the _____ valve is operating properly.

8. By depressing the button of the _____ valve, there should be an audible flow of oxygen into the closed breathing circuit, and a visible filling of the breathing bag.

9. Temperature extremes at which the apparatus will operate are from +14 degrees F (-10 degrees C) to about +300 degrees F (+145 degrees C) with a full, four-hour cylinder.

_____ TRUE FALSE _____

10. The preflush unit contains components so designed that when the cylinder shutoff valve is opened, the breathing bag is flushed with about _____ quarts of oxygen.

ANSWERS

- | | | | |
|----|------------------|-----|------------|
| 1. | 40 | 6. | c |
| 2. | d | 7. | Exhalation |
| 3. | True | 8. | by-pass |
| 4. | Heat-Temperature | 9. | True |
| 5. | False | 10. | 7 |



AERORLOX SELF-CONTAINED BREATHING APPARATUS

Procedures for getting under oxygen:

- (1) Visually check apparatus.
- (2) Put on facepiece and adjust.
- (3) Check facepiece for tightness.
- (4) Check timer.

Items to be checked prior to going underground and at 20-minute intervals:

- (1) Visually check team members as to comfort and proper operation of apparatus.
- (2) Check timer.
- (3) Check relief valve.

MINE RESCUE QUESTIONS
AERORLOX SELF-CONTAINED BREATHING APPARATUS

All questions are taken from MSHA Training Module Number 2005.

1. The relief valve pressure test on the Aerorlox breathing apparatus should be performed at intervals not to exceed 10, 20, 30, or 60 days.
2. The evaporating flow of the oxygen from the apparatus shall not be less than 3, 5, 7, or 10 liters per minute, 3 hours after filling.
3. An electrical alarm will sound for at least 15 minutes when approximately 30, 45, 60, or 90 minutes of duration remain.
4. A good storage vessel for liquid oxygen will evaporate liquid at about _____ liter per minute.
5. In reassembling the apparatus, ensure that any buildup of frost or ice on the _____ valve and its connection to the bottom of the evaporator has been washed off before reconnecting the breathing bag.
6. The purifying canister should be refilled with approximately 3.5 lb. or 8/12-mesh Protosorb.

_____ TRUE FALSE _____
7. The leak test of the evaporator must not be carried out with liquid oxygen in the apparatus.

_____ TRUE FALSE _____
8. With a _____ lb. charge of liquid oxygen, the Aerorlox may be used for a period of normally 3 hours.
9. In cleaning the apparatus, it is important to prevent _____ from entering the evaporator itself.
10. The function of the Protosorb contained in the purifying canister is to absorb _____ gas.

ANSWERS

- | | | | |
|----|-------|-----|----------------|
| 1. | 30 | 6. | True |
| 2. | 5 | 7. | True |
| 3. | 45 | 8. | 6.5 |
| 4. | 1 | 9. | Water |
| 5. | Spear | 10. | Carbon dioxide |



BIOMARINE BIOPAK 240 AND 240P 4-HOUR SELF-CONTAINED BREATHING APPARATUS

Procedures for getting under oxygen:

(1) Fill the CO₂ absorbent tray if the unit has not been stored in a ready-to-use condition, and install the tray in the unit. (2) Install the frozen coolant canister in the unit. (3) Don the unit; tighten the cinching straps, buckle the seat belt and attach the chest strap. (4) Hold the facepiece snugly against the chin. Pull the head harness over the head. Tighten the chin straps, then the temple straps and then the top head strap. Check to be certain that the nose cup fits properly over the nose and mouth. (5) Open the bottle valve fully. Listen for a short chirp from the alarm whistle. The bottle valve must be opened immediately AFTER donning the facepiece. Oxygen is wasted if the valve is turned on sooner. (6) Check the chest-mounted pressure gauge. It should read at least 3000 psig within one minute.

Items to be checked prior to going underground and at 20-minute intervals:

- (1) Visually check apparatus.
- (2) Check gauge.
- (3) Question member as to member's ability to continue.

MINE RESCUE QUESTIONS BIOMARINE BIOPAK 240 and 240P

All questions are taken from the Operation and Maintenance Manual or from the MSHA List of Statements of Fact for the BioPak 240 and 240P.

1. The BioPak 240 maintains a _____ pressure in the mask to prevent inward leakage of contaminants.
2. The regulator reduces the pressure from the oxygen bottle to approximately _____ psi.
3. The user should only use a _____ lubricant to lubricate o-rings.
4. The leak test fixture should be inflated to about a _____ degree angle.
5. The leak test fixture should be observed for _____ minutes to determine if the breathing system has any leaks.
6. The breathing system leak test, using the leak test fixture, also checks the unit for leaks in the plumbing.

_____ TRUE FALSE _____

7. The flow restrictor meters oxygen into the BioPak 240 and 240P at _____ liters per minute.
8. The by-pass valve will clear facepiece fogging.

_____ TRUE FALSE _____

9. The chest-mounted pressure gauge indicates service life when the oxygen bottle valve is open or closed.

_____ TRUE FALSE _____

10. The alarm whistle sounds when the cylinder pressure reaches approximately _____ psi.

ANSWERS

- | | |
|-------------|---------------|
| 1. Positive | 6. False |
| 2. 260 | 7. 1.78 + .13 |
| 3. Silicone | 8. False |
| 4. 45 | 9. False |
| 5. 2 | 10. 750 |



DRAEGER BG-4 BREATHING APPARATUS

Procedures for getting under oxygen:

1. Prior to donning the apparatus, make sure a filled cylinder, a fresh soda lime pack, and an ice block for the breathing air cooler are installed. Don the apparatus and adjust the harness and belt.
2. Don the facepiece by spreading the head harness with hands; put chin into chin support and pull harness over the head. Tighten the chin straps first, then the temple straps, and then the top head strap. The facepiece must be sufficiently tight on the face to prevent leakage of the breathing air which could shorten the duration of the apparatus.
3. Plug the breathing connector into the facepiece until it locks in place. Pull to verify it is secure.
4. Open cylinder valve fully.
5. Check the digital pressure gauge to see that a sufficient oxygen supply remains. The green LED light should be displayed. Press the by-pass valve to check the by-pass valve operation.
6. Check the facepiece tightness by tightly closing both breathing hoses and inhaling. The facepiece should collapse against the face, indicating there are no leaks. Exhale slowly and forcibly into the facepiece. pressure should build up in the facepiece before leaking between the facepiece seal and the face, indicating a good seal.

7. Each team member and apparatus should be rechecked by the team captain. The team captain and apparatus should be rechecked by a team member.

Items to be checked prior to going underground and at 20 minute intervals:

1. Visually check apparatus.
2. Check pressure gauge
3. Question member as to member's ability to continue.

MINE RESCUE QUESTIONS
DRAEGER BG-4

1. The minimum valve automatically activates when the _____ becomes deflated during heavy work.
2. When the warning alarm begins to beep for 30 seconds and the red LED flashes, it means that the oxygen cylinder pressure is below 750 psi.

_____ TRUE FALSE _____

3. A leak in a positive apparatus will have which of the following results:
 - a) Prevent infiltration of toxic gases
 - b) Activate the warning alarm
 - c) Shorten the duration of the apparatus
 - d) a & b
 - e) a & c
 - f) None of the above
4. To be filled to 3,135 psi, the 3,000 psi cylinder must be _____ rated by the hydro-tester.
5. Use of ice to cool the breathing gas is not necessary when the temperatures the apparatus will be used at is above 32°F.
6. When the BG-4 is stored, the breathing connector must be capped to prevent the following:
 - a) Leakage of oxygen from cylinder
 - b) Toxic gases infiltrating the breathing circuit
 - c) To maintain the ice block frozen
 - d) To maintain the soda lime fresh until ready for use
 - e) It is not required during storage
7. The mask should be donned only after the cylinder valve has been opened.

_____ TRUE FALSE _____
8. For maximum comfort, the weight of the BG-4 back-pack should rest on the _____ of the user.
9. The BG-4 electronic monitor will perform a high pressure leak test when the cylinder valve is turned on and automatically tests the _____ when the cylinder valve is turned off.

10. Which step is not included in the donning procedure:

- a) Open harness straps
- b) Plugging the connector in the facepiece
- c) Drain the water collection tube
- d) Open cylinder valve
- e) Check digital pressure indicator

ANSWERS:

- | | | | |
|----|---------------|-----|---------|
| 1. | Breathing bag | 6. | d |
| 2. | True | 7. | False |
| 3. | e | 8. | hips |
| 4. | Plus (+) | 9. | battery |
| 5. | False | 10. | c |

PRELIMINARY CHECKS OF GAS DETECTORS AND MEASURING DEVICES



MSA SPOTTER DIGITAL METHANE DETECTOR

Preliminary checks:

(1) To test the battery, depress the battery button. (2) The digital display should indicate at least 2.2 or the instrument needs to be recharged.

Testing for methane:

(1) Hold the instrument in the atmosphere to be tested. (2) Press the test button and read the display. This instrument tests for methane gas concentrations of 0 to 5 percent in air.



MSA PERMISSIBLE METHANE SPOTTER

Preliminary checks:

(1) Mechanical zero: pointer should rest within black area at zero. (2) Battery: press the test and check buttons simultaneously and hold for 15 seconds. Pointer should rest in battery segment of scale. If the pointer drops below the battery segment, the battery must be recharged. (3) Electrical zero: press the test button and hold for 15 seconds. Pointer should come to rest on zero.

Testing for methane:

(1) Hold instrument vertical and place thumb on test button. (2) Press test button, hold for 15 seconds (until pointer comes to rest). (3) Read scale. (4) Release button.



MODEL 102 DIGITAL METHANE DETECTOR

Preliminary checks:

(1) Place strap over your wrist. (2) Check battery charge: press test button at right side of case and battery check switch at left side of case, simultaneously. Hold both switches for 15 seconds. If the battery is at operating level, display digits will light and read 3.4 to 4.5 volts. At 3.5 it should be charged. (3) Check zero: press test button. A reading of 0.0 and 0.1 should appear within 7 seconds. If (MALF) comes on and flashes, do not use. If (MALF) comes on and stays on, do not use. (Problem is with the main circuit board.)

Testing for methane:

(1) Hold at sampling point. (2) Depress test button and hold depressed until display is illuminated and stable. This usually takes about 7 seconds. Note methane reading and release button. (3) Allow instrument to cool for at least one minute before making next test.

NATIONAL MINE SERVICE G-70 METHANOMETER

Preliminary checks:

- (1) Mechanical zero: Hold methanometer at 45 degree angle; pointer should rest at zero. (2)
Battery: Press either of the two range buttons; battery pointer should rest in white area. (3)
Electrical zero: Press either range button; pointer should rest at zero.

Testing for methane:

- (1) Place inlet at sampling point. (2) Press range button 2 or 5. (3) Keep button depressed during measuring cycle. (4) After pumping cycle is completed, read scale corresponding to range button used.



DRAEGER MULTI-GAS DETECTOR

Preliminary checks:

(1) The pump should be checked for airtightness before each use. (2) This is done by closing the suction opening of the pump head with an unopened tube and compressing the bellows. If the bellows has not opened in 10 minutes, the pump is airtight.

Operation:

(1) Break off both ends for the Draeger tube in the ampule breaker eyelet of the pump or in the breakoff husk by a rotation motion. (2) Tightly insert the Draeger tube in the pump head with the arrow pointing towards the pump. (3) Take the pump in the bellows as far as the stop. (4) Suction will be automatic and is completed when the chain is at full tension. (5) The number of strokes prescribed for the various Draeger tubes must be followed for each test.



ISC MODEL CD210 DIGITAL METHANOMETER

Checking instrument:

1. Visually check instrument for external damage.
2. Check the battery voltage by depressing the display button on the side of the case. The display should light and the low battery LED should not be lit. If the low battery LED lights or begins to blink, there are approximately 20 checks remaining.
3. Depress the “DISPLAY” button on the side of the case. The display should indicate -00.0, 00.0 or 00.1 percent.

Testing for methane:

1. Place instrument into area to be tested.
2. Depress the “DISPLAY” button and wait for the display to stabilize. (Normal response time is 5 to 10 seconds.)
3. Read the display for percent of methane.
4. Remove instrument.



ISC MODEL CD212 CONTINUOUS METHANE MONITOR

Checking instrument:

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The display should indicate -00.1, 00.0, or 00.1 percent. If the display is blanked out and a "1" with an arrow pointing at the words "LOW BATT" appear, the instrument should not be used.

NOTE: The sealed button on the side of the case is for backlighting the display and serves no other purpose.

Testing for methane:

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. Wait for the reading to stabilize and note the methane content shown on the display. An alarm will sound when the methane content exceeds 1 percent or at the percent the user has chosen.
3. Remove instrument.



ISC MODEL OX231 OXYGEN MONITOR

Checking instrument:

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)

NOTE: The sealed button on the side of the case is for backlighting the display and serves no other purpose.

2. Visually check instrument for damage.
3. To check battery, observe the display and see if the words "LO BAT" appear in the upper left corner. If they do, there are approximately 20 hours of battery life remaining and the instrument operates properly during these 20 hours. If the unit is used beyond this time, the alarm sounds continuously; the display is blanked out except for a "1" and a red LED will appear in the lower left corner of the display. When this occurs, the instrument cannot be used until the batteries are replaced.

Testing for oxygen:

1. Place instrument into area to be tested. Hold in area for 10 to 15 seconds and note reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the oxygen level falls below 19.5 percent or at the percent the user has chosen.
2. Remove instrument.



ISC MODEL CO260 CARBON MONOXIDE INDICATOR

Checking instrument:

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)

NOTE: The sealed button on the side of the case is for backlighting the display and serves no other purpose.

2. Visually check instrument for damage.
3. To check battery, observe the display and see if the words "LO BAT" appear in the upper left corner. If they do, there are approximately 20 hours of battery life remaining and the instrument operates properly during these 20 hours. If the unit is used beyond this time, the alarm sounds continuously; the display is blanked out except for a "1" and a red LED will appear in the lower left corner of the display. When this occurs, the instrument cannot be used until the batteries are replaced.

Testing for carbon monoxide:

1. Place instrument into area to be tested. Hold in area for 10 to 15 seconds and note reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the carbon monoxide content exceeds 50 ppm or at the level the user has chosen.
2. Remove instrument.



ISC MODEL MX240 COMBINATION OXYGEN/METHANE GAS MONITOR

Checking instrument:

1. Turn unit on by backing off knurled knob and inverting calibration cover. Tighten knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9 percent.
3. Depress the "DISPLAY" button on the side of the case. The display should indicate -00.1, 00.0 or 00.1 percent. If the display is blanked out except for a "1" with an arrow pointing at the words "LOW BATT" appears, the instrument should not be used.

Testing for methane/oxygen:

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. When reading has stabilized, note the oxygen shown on the display. An alarm will sound if the content falls below 19.5 percent or at the percent the user has chosen.
3. Depress the methane display button on the side of the instrument. The methane content will appear on the display, note reading. An alarm will sound when the methane content exceeds 1 percent or at the percent the user has chosen.

NOTE: If an instrument carrying MSHA approval number 8C-53-0 is exposed to concentrations of methane greater than 3 percent, the display will blank out and a "1" will appear. This will erase itself once the methane content falls below 3 percent. An instrument carrying MSHA approval number 8C-53-1 will not blank out when the methane concentration exceeds 3 percent. It will continue to measure methane concentrations above 3 percent.

4. Remove instrument.



MSA MINICO IV CARBON MONOXIDE DETECTOR

Testing for carbon monoxide:

The MiniCO IV operates continuously - there is no OFF/ON switch. To begin monitoring, the user simply removes the sensor cell plug. The MiniCO IV will then continuously monitor the ambient air for CO. To obtain an indication of CO concentration, the user simply presses the readout switch. The CO concentration is indicated by a digital LCD over the range of 0-500 ppm CO in air.

The MiniCO IV has built-in audible and visible alarms. When the CO concentration goes above the alarm setpoint, an alarm horn will sound continuously and a red LED will light. The alarm is set at 50 ppm by the factory, but can be adjusted anywhere from 25-500 ppm.

The battery condition is continuously monitored. When the battery needs to be replaced, the horn sounds a pulsating tone and the red LED flashes.



MSA THE KWIK-DRAW MULTI-GAS DETECTOR

Preliminary checks:

The pump should be checked for airtightness before each use. This is done by closing the suction opening of the pump with an unopened tube and compressing the bellows. If the bellows has not opened in 10 minutes, the pump is airtight.

Operation:

Break off both ends of the MSA tube in the tube breaker near the pump inlet. Insert the tube tightly in the pump head with the arrow pointing toward the pump. Compress the pump until the stroke counter advances to the next number. The stroke is completed when the end of the stroke indicator changes from yellow to black.



MSA MICROGARD MULTI-GAS DETECTOR

Preliminary checks:

1. These checks should be made in fresh air. Press the “ON/OFF” button to turn the instrument on. Wait approximately 15 seconds for the instrument to stabilize and for the alarms to clear. Press the “RESET” button to clear the alarm.
2. Press and hold the “BATTERY VOLTS” button for approximately five seconds. The battery reading should be 2.3 volts or higher. Recharge or replace batteries in fresh air if battery reading is below 2.3 volts.
3. Press the “SELECT” button until the LCD shows the percent CH_4 . The number should be zero plus or minus 00.2. If it is not zero, adjust “Z” potentiometer next to the “ CH_4 ” mark. This is located on the right side of the instrument behind a small gasketed protective cover.
4. Press the “SELECT” button until the LCD shows percent oxygen. This reading should be 20.8% oxygen. If the reading needs to be adjusted the “S” potentiometer next to the “OXY” on the side of the instrument is used.

Operation:

1. Leave the instrument on. Gas tests can now be made. Both gas alarms are functional regardless of what is displayed.
2. The instruction manual should be consulted for operating, calibrating or servicing details.



INDUSTRIAL SCIENTIFIC CORPORATION TMX412 MULTI-GAS MONITOR

Checking the instrument:

1. Turn the instrument on by pressing the MODE Button and hold until “Release” appears on the display. The MODE button is located on the bottom of the instrument between the red LED's. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensors are displayed. The TMX412 is capable of various sensor configurations. Operators can choose from oxygen, LEL or methane, and one or two of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide or chlorine.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The methane display should read -0.1, 0.0, or 0.1. The toxic gas should read -001, 000, or 001 for carbon monoxide and hydrogen sulfide and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide and chlorine.
5. Check the battery condition. There is an asterisk (*) on the display which indicates batter life. Each segment indicates approximately one hour of run time.

Testing for hazardous gases:

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.

2. The TMX412 will display up to four gases simultaneously. Once the gas reading have stabilized, note the content of gas as displayed by the chosen sensor.
3. The TMX412 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



**INDUSTRIAL SCIENTIFIC CORPORATION
LTX310 MULTI- GAS MONITOR**

Checking the instrument:

1. Turn on the instrument by pressing and holding the On/Off key until “Release” appears on the display. The On/Off Key is located on the faceplate of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the installed sensors are displayed. The LTX310 is capable of various sensor configurations. Operators can choose from oxygen, LEL or methane, and one of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, chlorine, hydrogen cyanide, nitric oxide and ammonia.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensors. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The methane display should read -0.1, 0.0, or 0.1. The toxic gas should read 0001, 000, or 001 for carbon monoxide, hydrogen sulfide, hydrogen cyanide, nitric oxide and ammonia and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide, and chlorine.
5. Check the battery condition. There is an asterisk (*) on the display which indicates battery life. Each segment indicates approximately one hour of run time.

Testing for hazardous gases:

1. Make sure the instrument is turned on and functioning properly. place the instrument in the area to be monitored.
2. The LTX310 will display up to three gases simultaneously. Once the gas reading shave stabilized, note the content of gas as displayed by the chosen sensor.
3. The LTX310 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm setting are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



INDUSTRIAL SCIENTIFIC CORPORATION STX70 PERSONAL GAS MONITOR

Checking the instruments:

1. Turn on the instrument by pressing and holding the “blue” function key and the “On” key simultaneously. The operation keys are located above the sensor on the front of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence. The STX70 is capable of detecting oxygen or one of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, chlorine, hydrogen cyanide, nitric oxide and ammonia.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas of the installed sensor. In clean air the following content of gas should be observed: oxygen is approximately 20.9% +/- 0.1%. The toxic gas should read -001, 000, or 001 for carbon monoxide, hydrogen sulfide, hydrogen cyanide, nitric oxide and ammonia and -00.1, 00.0, or 00.1 for sulfur dioxide, nitrogen dioxide, and chlorine.
5. Check the battery condition. Press the mode key “M” once. The gas identifier screen appears. Press the “+” key once and the “BATT” screen appears. Press the “E” key and battery status is displayed. If four, three, or two asterisks (*) appear the instrument will function properly. If only one (*) appears replace the two batteries as soon as possible.

Testing for hazardous gases:

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The STX70 will display one gas. Once the gas reading has stabilized, note the content of

gas as displayed by the chosen sensor.

3. The STX70 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



**INDUSTRIAL SCIENTIFIC CORPORATION
LD322 COMBUSTIBLE GAS MONITOR**

Checking the instrument:

1. Turn on the instrument by pressing and holding the On/Off Key until “Release” appears on the display. The On/Off Key is located on the faceplate of the instrument. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for any damage.
3. After turning the instrument on, the unit goes through a warm-up sequence in which the display is completely activated and then the selected sensor is displayed. The LD322 is capable of detecting in either LEL or percent by volume methane.
4. When the instrument completes the warm-up sequence it will display the current concentration of gas. In clean air the following content of gas should be observed: methane display should read -0.1, 0.0, or 0.1.
5. Check the battery condition. There is an asterisk (*) on the display which indicates battery life. Each segment indicates approximately one hour of run time.

Testing for hazardous gases:

1. Make sure the instrument is turned on and functioning properly. Place the instrument in the area to be monitored.
2. The LD322 will display combustible gases in LEL or methane. Once the gas reading has stabilized, note the content of gas as displayed for the sensor.
3. The LD322 has factory alarm settings which are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.



MSA PASSPORT MULTI-GAS DETECTOR

Preliminary checks

1. These checks should be made in fresh air. Press the “ON/OFF” button to turn the instrument on.
2. A request for “Fresh Air Setup” will appear on the display. Within five seconds press the “Page” button to activate the fresh air setup to function. This will automatically set the oxygen readout to 20.8% oxygen and zero the carbon monoxide and methane sensors. When the fresh air setup is complete the gases will be displayed.
3. The “Reset” button can be used to clear alarm conditions. Pressing any button will activate the back light.
4. The “Page” button can be used to scroll through other pages of information. All gas alarms are functioning regardless of the meter display.



ISC MODEL HS267 HYDROGEN SULFIDE MONITOR

Checking the instrument:

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.) Note: The sealed button on the side of the case is for back lighting the display and serves no other purpose.
2. Visually check the instrument for damage.
3. To check battery, observe the display and see if the words "LOBAT" appear in the upper left corner. If it does, there are 20 hours or less of battery life remaining. During this time the instrument will operate properly. If a unit goes beyond the 20 hours, the display will blank out except for a 1 in the far left side of the display and the audible and visual alarm will be activated. When this condition occurs the unit cannot be used until the batteries are replaced.

Testing for hydrogen sulfide:

1. Place the instrument into the area to be tested. Hold instrument in the area for 10 to 15 seconds and note the reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the hydrogen sulfide content exceeds 10 ppm or the level the user has chosen.
2. Remove the instrument.
3. Refer to the instruction manual for further operating and calibration information.



ISC MODEL CMX270 COMBINATION OXYGEN/ METHANE/CARBON MONOXIDE GAS MONITOR

Checking the instrument:

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9%.
3. Depress and release the CO (carbon monoxide) button on the instrument's faceplate. The display should read -001, 000, or 001 ppm.
4. Depress and release the CH₄ (methane) button on the instrument's faceplate. The display should read -00.1, 00.0, or 00.1 percent. If the display is blanked and the words "LOBAT" appear in the upper left corner of the display, the instrument's battery is low and the instrument should not be used until the battery is recharged. Testing for oxygen/methane/carbon monoxide:
 1. Make sure the instrument has been turned on and place it in the area to be tested.
 2. When the oxygen reading has stabilized, note the oxygen content shown on the display. Audible and visual alarms will be activated when the oxygen content falls below 19.5% or rises above 23.0% or at the values chosen by the user.
 3. Depress and release the CH₄ (methane) button. A methane reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 1.0% or at the percent the user has chosen.
 4. Depress and release the CO (carbon monoxide) button. A carbon monoxide reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 50 ppm or at the ppm level the user has chosen.

5. Remove the instrument.
6. Refer to the instruction manual for further operating and calibration information.



ISC MODEL CO262 CARBON MONOXIDE MONITOR

Checking the instrument:

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.) Note: The sealed button on the side of the case is for back lighting the display and serves no other purpose.
2. Visually check the instrument for damage.
3. To check battery, observe the display and see if the words "LOBAT" appear in the upper left corner. If it does, there are 20 hours or less of battery life remaining. During this time the instrument will operate properly. If a unit goes beyond the 20 hours, the display will blank out except for a 1 in the far left side of the display and the audible and visual alarm will be activated. When this condition occurs the unit cannot be used until the batteries are replaced.

Testing for carbon monoxide:

1. Place the instrument into the area to be tested. Hold instrument in the area for 10 to 15 seconds and note the reading on the display. (Instrument operates continuously. A 10 to 15 second period is only necessary in test boxes.) An alarm will sound if the carbon monoxide content exceeds 50 ppm or at the level the user has chosen.
2. Remove the instrument.
3. Refer to the instruction manual for further operating and calibration information.



ISC MODEL NO268 NITROGEN DIOXIDE MONITOR

Checking the instrument:

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.) Note: The sealed button on the side of the case is for back lighting the display and serves no other purpose.
2. Visually check the instrument for damage.
3. To check battery, observe the display and see if the words "LOBAT" appear the upper left corner. If it does, there are 20 hours or less of battery life remaining. During this time the instrument will operate properly. If a unit goes beyond the 20 hours, the display will blank out except for a 1 in the far left side of the display and the audible and visual alarm will be activated. When this condition occurs the unit cannot be used until the batteries are replaced.

Testing for nitrogen dioxide:

1. Place the instrument in the area to be tested. Hold instrument in the area for 25 to 30 seconds and note the reading on the display. (Instrument operates continuously. A 25 to 30 second period is only necessary in test boxes.) An alarm will sound if the nitrogen dioxide content exceeds 1.0 ppm or at the level the user has chosen.
2. Remove the instrument.
3. Refer to the instruction manual for further operating and calibration information.



**ISC MODEL MX250
COMBINATION OXYGEN/METHANE GAS MONITOR**

Checking the instrument:

1. Turn the unit on by backing off the knurled knob and rotating the calibration cover one half turn. Tighten the knurled knob. (Do this prior to starting the clock for the working of the contest problem.)
2. Visually inspect the digital display. The oxygen content should be approximately 20.9%.
3. Depress and release the C_{H_4} (methane) button on the instrument's faceplate. The display should read -00.1, 00.0, or 00.1 percent. If the display is blanked and the words "LOBAT" appear in the upper left corner of the display, the instrument's battery is low and the instrument should not be used until the battery is recharged.

Testing for oxygen/methane:

1. Make sure the instrument has been turned on and place it in the area to be tested.
2. When the oxygen reading has stabilized, note the oxygen content shown on the display. Audible and visual alarms will be activated when the oxygen content falls below 19.5% or rises above 23.0% or at the values chosen by the user.
3. Depress and release the CH_4 (methane) button. A methane reading will appear on the instrument's display, note this reading. Audible and visual alarms will be activated when methane content exceeds 1.0% or at the percent the user has chosen.
4. Remove the instrument.
5. Refer to the instruction manual for further operating and calibration information.



ISC MODEL TMX410 MULTI-GAS MONITOR

Checking the instrument:

1. Turn the unit on by loosening the knurled knob and rotating the calibration cover one quarter turn. The on-off switch is located under the calibration cover. The TMX410 is turned on by moving the switch (left) to the on position. (Do this prior to starting the clock for working the contest problem.)
2. Visually check the instrument for damage.
3. At turn on, the unit goes through a warm-up sequence in which battery status and sensor identification are revealed. The TMX410 can accommodate various sensor combinations. Operators can choose from oxygen, LEL or methane, and one or two of the following toxic gases: carbon monoxide, hydrogen sulfide, sulfur dioxide, nitrogen dioxide, and chlorine.
4. The oxygen content should be approximately 20.9%. The methane display should read -00.1, 00.0, or 00.1 percent. The toxic display(s) should read -001, 000, 001 ppm for carbon monoxide, hydrogen sulfide and -00.1, 00.0, or 00.1 ppm for sulfur dioxide, nitrogen dioxide, and chlorine.

Testing for hazardous gases:

1. Make sure the instrument has been turned on and place it in the areas to be monitored.
2. The TMX410 displays up to four sensor outputs simultaneously. Once the gas readings have stabilized, note the content of gas as read by the chosen sensors.
3. The TMX410's factory alarm settings are consistent with MSHA guidelines and units will alarm when gas levels exceed these limits. Alarm settings are resettable and the unit will alarm at the user chosen values.
4. Refer to the instruction manual for further operating and calibration information.

GLOSSARY OF TERMS

ACCESSIBLE - Able to be traveled into; not impassable.

ADIT - A nearly horizontal passage from the surface by which a mine is entered.

AIR LOCK - An area in the mine closed at both ends by two doors or two bulkheads. An air lock is used to prevent mixing of different atmospheres while still permitting miners to enter and exit.

AIR SHAFT - Shaft used exclusively for conducting air.

AIR SPLIT - The division of an air current into two or more parts.

AIR TRACK DRILL - A heavy drill mounted on crawler tracks.

AIRWAY - Any passage through which air is flowing.

ALTERNATE - Person qualifying to participate as a mine rescue team member. Can replace any team member who cannot continue or who is removed from the problem.

ATMOSPHERIC PRESSURE - Force exerted by air. Atmospheric pressure is measured on a barometer.

ATTENDANT - Person who assists the team at the fresh air base.

AUXILIARY FAN - A small, portable fan used to supplement the ventilation of an individual working place.

AUXILIARY VENTILATION - Portion of main ventilating current directed to face of dead-end entry by means of an auxiliary fan and tubing.

BACK FILL - The rough material used to refill a place from which the earth has been removed.

BACK/ROOF - That part of an opening which is nearest the surface in relation to any portion of the workings of the mine, the roof. Overhead surface of an underground opening.

BACKUP TEAM - The rescue team stationed at the fresh air base as a ©backup^a for the working team beyond the fresh air base.

BAFFLE - A device used to deflect, check or regulate the flow of air.

BARRICADE - Enclosed part of mine to prevent inflow of noxious gases from a mine fire or explosion. This may be done by doors or by building one or more airtight walls using any available materials such as rock, wood, brattice cloth, mud, clothing, etc., so as to enclose a maximum quantity of good air. If contact is not made with person behind the barricade, conditions inside the barricade will be unknown.

BARRICADING - Enclosing part of mine to prevent inflow of noxious gases from a mine fire or an explosion.

BATTERY LOCOMOTIVE - Battery powered machine used for moving cars within the mine.

BATTERY CHARGING STATION - Area set aside for charging and storing batteries.

BATTERY OPERATED EQUIPMENT - Any equipment powered by batteries.

BELT FEEDER - The dump end of a belt system. To disperse ore on the belt.

BLASTING BOX - The unit used for firing of one or more charges electrically.

BLASTING CAPS - A detonator containing a charge of detonating compound, which is ignited by electrical current or the spark of a fuse used for detonating explosives.

BOREHOLE - Any deep or long drill hole. It may be a source of air, supplies and communications in an emergency.

BORER - A device for making large holes.

BRATTICE CLOTH - Fire-resistant fabric or plastic used in a mine passage to control ventilation.

BRIEFING - Session held before a team goes underground to inform team members of conditions underground and give them their work assignment.

BULKHEAD - A wall or partition constructed across a passageway to direct the ventilating air in its proper course.

CAGE - A shaft conveyance used in hoisting personnel and materials.

CAVED - Ground which has fallen.

CAVED IMPASSABLE - Incapable of being passed, traveled, crossed, or surmounted, but allows some ventilation flow.

CAVED TIGHT - Ground caved in to prevent access and allows no ventilation flow.

CHOCKS - Wedge shaped blocks to put under vehicle wheels to prevent movement.

CHUTE/ORE PASS - Vertical or inclined passageway for downward movement of ore.

CONTINUOUS MINER - A mining machine designed to remove ore from the face and load it into cars or conveyors.

CRIB BLOCKS - Blocks used to support.

CROSSCUT - A horizontal opening driven across the direction of the main workings; a connection between the two drifts or tunnels.

CURTAIN - Brattice cloth, canvas or plastic curtain used to deflect or direct air into a working place. Constructed in a manner to allow the passage of miners and machinery.

CUTTING MACHINE - A power (electric) driven machine used to undercut ore.

DEBRIEFING - Session held when teams return to the surface after completing an assignment to review what they saw and did.

DETONATING FUSE - A round, flexible cord containing a center core of high explosives. (Primacord)

DETONATOR - A device used for detonating explosives.

DISTRIBUTION BOX - An enclosure through which electric power is carried to one or more cables from a single incoming feed line.

DOWNCAST - An opening through which fresh ventilating air is drawn or forced into the mine; the intake.

DRIFT/ENTRY - A passage underground

EXHAUST - The air course along which the air of the mine is returned or conducted to the surface.

FACE/RIB - Vertical surface of an underground opening.

FEEDER - Small cracks in rock strata from which gas escapes.

FILL - Any material that is put back in place of the extracted ore.

FLOOR - That part of any underground opening upon which one walks.

FOOTWALL - Lower side of a dipping ore body.

FRESH AIR BASE - Base of operations from which the rescue and recovery teams can advance into irrespirable atmospheres.

FRONT-END LOADER - Self-propelled machine used for moving or loading muck.

HANGING WALL - Upper side of a dipping ore body.

HOLE CHARGED - A drilled hole that is charged with explosives ready to be blasted.

IMPASSABLE - Incapable of being passed, traveled, crossed, or surmounted.

INACCESSIBLE AREAS - All areas of the mine where team travel is blocked by one of the following conditions: seals, unsafe roof rib to rib that cannot be supported or scaled, inextinguishable fires, water over knee deep, or caved impassable falls.

INCLINE/SLOPE - A nonvertical shaft, usually on the dip of a vein.

INTAKE - The passage through which fresh air is drawn or forced into a mine.

INTENSE HEAT - Air heated to the extent that it cannot be entered.

INTERSECTION - For contest work, any area driven 3 feet or more off a drift.

LAGGING - Materials used for flooring or shoring.

LEAD WIRE - Wire used to fire electric detonators.

LIFELINE - Rope, line, or cable that links the team to the fresh air base.

LINE BRATTICE - Fire-resistant fabric or plastic partition used in a mine passage to direct the air into the working place. Also termed ©Line Canvas or Line Curtain.^a

LOADING MACHINE - A machine to load broken ore or rock.

LONG HOLE DRILL - A drill using sectional steel to drill holes to greater depths.

LOOSE BACK - Unstable overhead surface which must be controlled before entry.

LOOSE RIB - Unsupported loose ground on the side of the drift.

MAGAZINE - A storage place for explosives or for detonators.

MANDOOR - Door installed in a permanent stopping (bulkhead) to allow persons to travel from one drift to another.

MANHOLE - A refuge hole constructed in the side of a drift.

MANTRIP - A trip on which personnel are transported to and from a work area.

MINE DOOR - A large, hinged door used to close off a mine entry.

MISFIRE - The complete or partial failure of a blasting charge to explode as planned.

MOTOR - Machine usually on a track used for tramming ore or supplies.

ORE PASS - A vertical or inclined passage for the downward transfer of ore.

OVER CAST - Enclosed airway built at an intersection of mine passages that permits one air current to pass over another air current without mixing.

PERMISSIBLE - A machine, material, apparatus or device which has been investigated, tested and approved by MSHA for use in gassy mines.

PILLAR - A column of ore or rock left in place.

POST - A mine timber.

RAISE - A vertical or inclined opening driven upward.

RAISE CLIMBER - Equipment used in an opening (raise) that is mined upward.

REFUGE CHAMBER - An airtight, fire-resistant room in a mine used as a method of refuge in emergencies by miners unable to reach the surface.

REGULATOR - An adjustable door or opening in a stopping, used to control and adjust the quantity of airflow.

RETURN AIR - The air that has passed through the working areas of the mine.

RIB - The wall of a mine opening.

ROOF BOLTER - A machine designed to drill holes in the roof and install bolts.

ROOF BOLTS/ROCK BOLTS - A long bolt inserted and anchored in holes drilled in the rock.

ROOF JACKS-- A roof support designed for immediate temporary use.

SCALING BAR - Tool with a flat point and a heel used to pry in a crack of the rock.

SEAL - A stopping built of greater thickness and more substantial construction used to isolate abandoned areas of the mine from the active workings or to isolate a fire.

SHAFT - A vertical opening of limited area compared with its depth, made for finding or mining ore, raising ore, rock or water, hoisting and lowering workers and materials, or ventilating underground workings.

SKIP - A hoisting bucket, which slides between guides in a shaft.

SLUSHER/SCRAPER - A machine for transferring or loading rock by pulling an open bottomed scoop back and forth from the face to the loading point by means of a drum hoist, cables and sheaves.

SPLIT - To divide the air current in two or more separate currents.

STOPE - An excavation in a mine, other than development workings, made for the purpose of extracting ore.

STOPER - A pneumatic hammer drill used for drilling upward.

STOPPING - A permanent or temporary wall or partition constructed across a passageway to direct the ventilating air.

STULL/PROP - Column of wood or steel used for support of underground openings.

SUMP - An excavation in the shaft or mine made below the mining level to collect mine water.

SUPPLY PLATFORM - Area set aside for storage of materials.

SURVIVOR - Person found alive in the mine.

SWITCH - An electrical switch.

TAGLINE - Short line no longer than 3 feet hooked from a team member to the team line.

TEAM LINE - Line that links team members together (extension of lifeline).

TIMBER SET - Tunnel support consisting of a roof beam or arch and two posts.

TYING ACROSS AND BEHIND - Systematic exploration of all intersecting and adjacent passageways so that the team is never forward (toward the working face) of an accessible, unexplored area.

UNDERACT - An enclosed airway built at an intersection of mine passages that permits one air current to pass under another air current without mixing.

UPCAST - The opening through which the return air is removed from the mine. The opposite of downcast or intake.

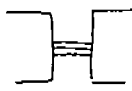
VENT BAG - An enclosed airway to direct airflow to a given area or location.

WINZE - An opening, like a small shaft, sunk from an interior point in a mine.

WORKING PLACE - Any place in or about a mine where work is being performed.

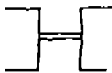
MINE MAP LEGEND

This legend must be used by all teams participating in the National Mine Rescue Contest.



Seal

If the seal is equipped with devices such as sampling tubes or water traps, or is damaged, leaking, or destroyed that particular device or condition is noted beside the symbol.



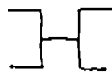
Permanent Stopping Intact

Stopping is intact, airtight. (No indication of opening or leakage.)



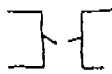
Permanent Stopping Not Intact

Stopping may be destroyed, partially destroyed or have openings. Is not airtight. Condition noted on placard is to be shown on map beside symbol.



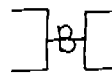
Temporary Stopping Intact

Stopping is intact and airtight. This symbol is used for all structures built by the team, such as airlocks, etc.



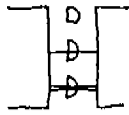
Temporary Stopping Not Intact

Stopping may be destroyed, partially destroyed, or have openings. Is not airtight. Condition noted on placard is to be shown on map beside symbol



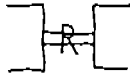
Barricade

Any information on a placard, such as leaking, damaged, destroyed, etc. shall be noted on mine map beside symbol.



Door

The “D” symbol can be shown by itself, in permanent or temporary stopping. Type, size, and open or not if indicated on placard, must be indicated on map beside symbol. The curve of the “D” indicates direction of door opening.



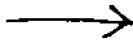
Regulator

If the regulator is **damaged**, leaking, or **destroyed**, condition must be shown on map. Also, indicate whether open (how much), or closed.



Fire

Write out any information given on placard about fire, on map beside symbol.



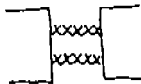
**Air
Movement**

Show arrow in direction of movement as indicated on placard, and show any quantity, if given, or other information, such as flow velocity. Put on map beside symbol.



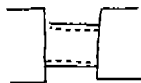
Water

Indicate depth or any other information as shown on placard. Put on map beside symbol.



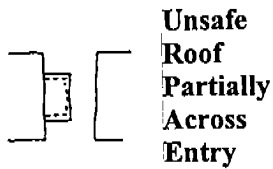
Caved

Caved areas are not considered airtight unless so stated on placard. Write out any information on placard beside symbol on map.



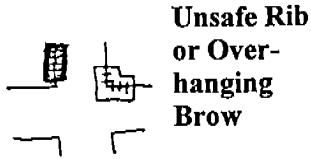
**Unsafe
Roof
Across
Entry
Rib-to-Rib**

Symbol used for any indication of questionable roof conditions. May or may not be scalable. Write out any other information on placard on map beside symbol.



**Unsafe
Roof
Partially
Across
Entry**

Symbol used for any indication of questionable roof conditions. May or may not be scalable. Write out any other information on placard on map beside symbol.



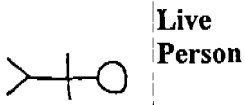
**Unsafe Rib
or Over-
hanging
Brow**

Symbol used for any indication of questionable rib conditions. May or may not be scalable. Project over rib line area on map. Write out any other information on placard on map beside symbol.



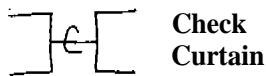
Body

Indicate position of head and feet as body is found. If word "body" is on placard, show symbol. Indicate any additional information on placard on map beside symbol.



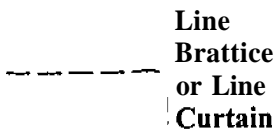
**Live
Person**

Indicate position of head and feet as found. Write out condition, such as conscious, walking, etc. Indicate any injuries as given on placard. Write out information on map beside symbol.



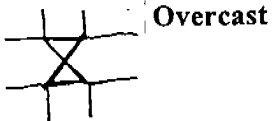
**Check
Curtain**

Condition of check if noted on placard, must be shown on mine map beside symbol. Ex. "Partially down"










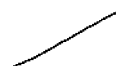

**Line
Brattice
or Line
Curtain**

The full extent of curtain shall be shown. If the curtain is partially or completely down, it must be noted on the map beside the symbol.



Overcast

If it is damaged, leaking, or destroyed, that particular condition is to be noted on the map beside the symbol.

| | | |
|---|--|---|
|  | Undercast | If it is damaged leaking, or destroyed, that particular condition is to be noted on the map beside the symbol. |
|  | Fan | Write out the conditions of the fan, and any other information indicated on placard on the map beside the symbol. |
|  | Fan with Tubing | Write out the conditions of the fan, tubing, vent bag or placard on the map by symbol. |
|  | Brattice Frames | Indicate any information on placard on mine map beside symbol. |
|  | Brattice Cloth or Brattice Material | Indicate any information on placard on mine map beside symbol. |
|  | Gas Mixture | Use for any placard indicating a gas or a mix of gases in the mine atmosphere. Write out the gas name or symbol and indicate PPM or % if shown on placard. |
|  | Smoke | Write out light, heavy, dense, or any other information indicated on placard, on map beside the symbol. |
|  | Elongated Object | For use in indicating pipelines, cables, and other objects usually found that are of any length. Do not use for cable coiled, etc. Write out any other information about object on map beside symbol. |
|  | Track | Write out any information noted on placard on map beside symbol. |



**Mobile
Equipment**

Use for all mobile face equipment. Write out any **other** information given **on** placard on map beside symbol on map.

50

**50 Foot or
First Team
Check Inby
Fresh Air
Base**

Used for 50 foot check of team members.

20

**20 Minute
Apparatus
Check**

Used for every 20 minute apparatus check of team members.

FPA

**Farthest
Point of
Advance**

Should be used only where areas inby will not be explored for whatever reason. Not to be used where other conditions block travel.

DI

**Captain's
Date and
Initial**

Use for all locations where the team captain dated and wrote his initials.

PC

**Power
Center**

Self explanatory - Write out any information noted on placard.

X

**Other
Objects,
Conditions,
or
Equipment**

Write the name of the object, condition, or equipment and other information indicated by placard on map beside the symbol. This would include a "face" if marked by a placard.